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GEOGRAPHY.

THE FRENCH EXPEDITION TO AFRICA.*

BY CAPTAIN H. W. HOWGATE, U. S. A.

Access to Equatorial Africa has always been more difficult from the western than from the eastern coast, and the burden of effort from that direction has fallen upon France, whose colonies on the west coast have given her especial interest in the subject. The expedition which terminated its work in 1878, after three years of labor, of suffering and of danger, had for its primary object the exploration of the principal river of the French-African possessions—the Ogoônè. It was officered by M. de Brazze and Dr. Ballay, who were assisted, in the early part of their work, by M. Marche, who had, on a previous expedition, added much to the knowledge of the course of this river. M. Marche was soon compelled to abandon his companions on account of the impaired state of his health, and they were left to push on without his assistance. Both M. de Brazze and Ballay were, from the first, sufferers from the malarial influences of the climate, but never wholly gave way. They had for escort twelve native soldiers of Senegal, in the French service, commanded by a subaltern named Hamon.

From the start the explorers were forced to struggle against the ill-will and cupidity of the blacks. This struggle was intensified as the distance from the

*Translated from the French for the REVIEW.

coast increased, and as they passed from one tribe to another, until at length it was transformed into open hostility.

The course of the Ogoônè can be divided into three nearly equal parts—the upper, the middle and the lower. The middle follows very nearly the equatorial line; the two others incline about a degree and a half toward the south; the one toward its source, the other toward its mouth. The baggage of the party was transported by canoes, and at times in the arms of the natives. The Inenga conducted the expedition to the middle portion of the river, where, reaching the territory of the Okanda, they refused to proceed further.

A first halt was made at Lopé, a large town upon the middle section of the river. From this point M. de Brazze made an excursion by land into the country of the Faus, with whom he established friendly relations. He went as far as Domnè, a point well advanced on the upper section of the river, where he was joined by Dr. Ballay in August, 1876. Here M. de Brazze, overcome by his long voyage on foot, was taken seriously ill. When he became restored to health he proceeded to collect in person all the articles of trade they had started with, for the purpose of obtaining with them the necessaries of life in the interior of Africa. This caused much delay, and he did not rejoin his companions at Domnè until April, 1877. When ready to set out the natives raised new difficulties. They accused the whites of bringing into the country dangerous maladies; demanded enormous prices for tranportation of baggage, and finally insisted upon a share of the merchandise itself. The situation was critical, and a collision was averted only by an expedient. They filled secretly a certain number of cases in such manner as to leave a stock of empty ones, sufficient in outward appearance to satisfy the rapacity of the natives. The full cases were taken off by Dr. Ballay and M. Hamon, while M. de Brazze, with some of the soldiers, remained behind and feigned a close guard upon the empty ones.

When he thought that his companions had reached the limits of the advance territory, M. de Brazze, with his soldiers, embarked in a canoe, and after many dangers, joined the expedition at the falls of Poubara, above which the Ogoônè is reduced to a insignificant stream of water.

The expedition might have terminated here, for the question as to whether the river afforded, as had been believed, a means of communication with the great interior lakes was decided in the negative.

But the courageous explorers were not content with this. After several day's rest, and in spite of their poor state of health, and the reduced condition of their supplies, they resolved in March 1878, to leave the basin of Ogoônè, and penetrate farther still into the interior. The last experiment they made here in the employment of the natives proved disastrous. They were twenty days in making ten kilometres, and several of their cases of merchandise were pillaged.

At this point they were driven to the purchase of a sufficient number of slaves to carry their effects, in order to free themselves from the exactions of the natives.

In this manner they traversed successively the territories of Ondonubo, of Umbété, and of Baliki, when they made such diligence as to prevent the intended robbery of their baggage by the natives, with the assistance of the carriers.

After quitting the basin of the Ogoônè, the expedition suffered greatly from hunger and thirst, for the country traversed had been devastated by famine. A watercourse, N'gambo, running toward the East led the explorers to an important river, the Alima, which appears in geography for the first time.

This river is over one hundred yards in width with a depth of fifteen feet, and is doubtless one of the affluents of the Congo. M. de Brazze and his comcompanions thought, however, at first that by following its course they would eventually reach the Atlantic, although its course at first led in a opposite direction.

They soon met with menacing demonstrations from the natives, which were soon followed by actual assault in which three of the party were wounded by bullets, and they were compelled in self-defense, to use their own weapons.

On the evening of the same day they arrived in sight of two large towns, one upon each bank of the river, and both full of enemies. Wishing to avoid a night combat upon the water M. de Brazze disembarked his party and intrenched himself. At break of day he was assaulted by thirty canoes full of natives, armed with muskets. The battle was short; the blacks were dispersed after having proved the superiority of European arms and skill.

It was not safe to persue the perilous route farther with so few guns and with such reduced force, and accordingly the explorers left the river, which continued to flow eastward, and moved toward the north, where they naturally expected less inhospitable treatment, but where, unfortunately, they found but few provisions. After having crossed several streams which flowed eastward, M. De Brazze sent Dr. Ballay and M. Hamon towards the Ogoônè, and alone continued his exploration to the Equator. It was an act of supreme heroism, as for five months he suffered hunger, fever and bodily pain.

He was finally compelled to return before the rainy season began, and, rejoining his companions, they descended the Ogoônè, and on the 30th day of November, 1878, reached Gabon.

In summing up this expedition it is seen that for three years, fifteen months of which were spent beyond the reach of civilized man, the explorers had to support great sufferings and to combat great dangers. They opened to the world an area in Central Africa previously absolutely unknown—larger than many of the smaller European States.

COAL DEPOSITS IN CENTRAL AFRICA.

A letter addressed from Livingstonia, under date of September 12, 1878, announces that a mine of coal has been discovered in Central Africa upon the borders of Lake Nyanza.

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Mr. Rhodes, who accompanied Capt. Nelton in a combined hunting and exploring expedition, had reached the southern extremity of the lake, and thence proceeded along its western shore.

About a mile from the lake and twelve miles south of Florence Bay, he reached, in ascending a ravine, an elevated plateau of sandstone, in which, at an elevation of about four hundred feet above the lake, he found in the bed of the ravine, some little fragments of carbon. On continuing his investigations he discovered three distinct veins of carbon in the ground, one of which was not less than seven feet, and the other two from one to three feet in thickness.

SOUTH AFRICAN EXPLORATION.

Pinto, the Portugese explorer, telegraphs his arrival at Pretoria with eight followers left of the 400 with whom he set out on his expedition across the African Continent, from east to west. He reports he has saved all his papers, consisting of twenty geographical charts, many topographical maps, three volumes of notes, meteorological studies, drawings, and a diary of the complete exploration of the Upper Zambesi, with its seventy-two cataracts.

SELECTION OF AN INTERNATIONAL MERIDIAN.

A writer in a recent number of *La Nature* argues in favor of the establishment of an international meridian, and recommends for this purpose the meridian 10° east of Paris, which passes through Venice and near Rome (name so dear to history and so well known to geographers). He also proposes the establishment upon the island of Levanzo, through which this meridian passes, an international astronomical observatory, to be the common property of all civilized nations. For this purpose, it is assumed that the Italian Government would cede to the scientific world the control of this little island.

He also suggests that the United States cede, for the same purpose, a part of Oonalaska, through which the one hundred and eightieth meridian would pass. The two observatories thus established would be under uniform control.

AN AFRICAN HARBOR OF REFUGE.

In a recent discourse before the Scientific Association of France, M. de Lesseps explained his plan for the establishment upon the Niger, at a point in the great curve which that river makes toward the north, a place of refuge for slaves, which would also be a center of civilization in that benighted region, under the direction of the French section of the African Association.

This plan will probably form the first subject of discussion of a commission

which the Geographical Society of France proposes to form and which, composed of persons delegated by that society, by the African Association, and by the Society of Commercial Geography, of Paris, will occupy itself specially with the exploration and commercial development of the region comprised between Algiers, Tunis, Senegal and Senegambia.

BREMEN, March 10, 1879.

SIR: Herewith I have the honor to inform you that on the 15th of March I shall resign my charge as honorary secretary of the Bremen Geographical Society, and, remaining member of the council of the latter, shall transfer my residence to Gotha. I beg to direct all letters, journals, etc. for our society, from that date, to my successor, A. W. Wolkenhauer, Ph. D., Bremen, Besselstrasse, No. 29. Communications for me, I beg to send to

DR. M. LINDEMAN,

Co-editor of Dr. Peterman's *Mittheilungen*, Gotha, care of Justus Perthes.

GOVERNMENT SURVEYS.

The following is a summary of the Congressional action consolidating the several surveys made under direction of the Government, taken at the session which terminated March 4, 1879:

The Director of the Geological Survey, which office is established under the Interior Department, shall be appointed by the President, by and with the advice and consent of the Senate. This officer shall have the direction of the Geological Survey and the classification of the public lands and examination of the geological structure, mineral resources and products of the national domain. The Director and members of the Geological Survey shall have no personal or private interests in the lands or mineral wealth of the region under survey, and shall execute no surveys or examinations for private parties or corporations. The Geological and Geographical Survey of the Territories, and the Geographical and Geological Survey of the Rocky Mountain Region, under the Department of the Interior, and the Geographical Surveys west of the one hundredth meridian, under the War Department, are discontinued, to take effect on the thirtieth day of June, eighteen hundred and seventy-nine. All collections of rocks, minerals, soils, fossils, and objects of natural history, Archæology and Ethnology, made by the Coast and Interior Survey, the Geological Survey, or by any other parties for the Government of the United States, when no longer needed for investigations in progress, shall be deposited in the National Museum.

A commission on the codification of existing laws relating to the survey and disposition of the public domain is appointed, to consist of the Commissioner of the General Land Office, the Director of the United States Geological Survey, and three civilians, to be appointed by the President. Neither the Commissioner of the General Land Office nor the director of the United States Geological Survey shall

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receive other compensation for their services upon said commission than their salaries, respectively, except their traveling expenses, while engaged on said duties; and it shall be the duty of this commission to report to Congress within one year from the time of its organization; first, a codification of the present laws relating to the survey and disposition of the public domain; second, a system and standard of classification of public lands; as arable, irrigable, timber, pasturage, swamp, coal, mineral lands and such other classes as may be deemed proper, having due regard to humidity of climate, supply of water for irrigation, and other physical characteristics; third, a system of land parceling surveys adapted to the economic uses of the several classes of lands; and, fourth, such recommendations as they may deem wise in relation to the best method of disposing of the public lands of the western portion of the United States to actual settlers.

The publications of the Geological Survey shall consist of the annual report of operations, geological and economic maps illustrating the resources and classification of the lands, and reports upon general and economic geology and palæontology. The annual report of operations of the Geological Survey shall accompany the annual report of the Secretary of the Interior. All special memoirs and reports of said survey shall be issued in uniform quarto series, if deemed necessary by the Director, but otherwise in ordinary octavos. Three thousand copies of each shall be published for scientific exchanges and for sale at the price of publication; and all literary and cartographic materials received in exchange shall be the property of the United States, and form a part of the library of the organization; and the money resulting from the sale of such publications shall be covered into the Treasury of the United States.

Copy of an act authorizing the Secretary of the Navy to accept for the purpose of a voyage of exploration by way of Behring's Straits, the ship Jeannette, tendered by James Gordon Bennett for that purpose.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That the Secretary of the Navy be, and he is hereby authorized to accept and take charge of, for the use of a north polar expedition by way of Behring's Straits, the ship Jeannette, owned by James Gordon Bennett, and by him devoted to this purpose; that he may use, in fitting her for her voyage of exploration, any material he may have on hand proper for the purposes of an arctic voyage; and that he is further authorized to enlist the necessary crew for said vessel for "special service," their pay to be temporarily met from the pay of the navy, and to be paid or refunded by James Gordon Bennett to the Navy Department under the order of the Secretary of the Navy and as he may require; the vessel to proceed on her voyage of exploration under orders and instructions of the Navy Department; that the men so "specially enlisted" as above shall be subject in all respects to the Articles of War and Navy Regulations and discipline; and that all parts of the act approved March eighteenth, eighteen hundred and seventy-eight, inconsistent with the above, be, and they are hereby, repealed: *Provided,* That the government of the United States shall not be held liable for any expenditure incurred or to be incurred on account of said exploration.

Approved, February 27, 1879.

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ANTHROPOLOGY.

THE BIBLE NARRATIVE AND HEATHEN TRADITIONS.

Traces of the Facts mentioned in Genesis found in the Traditions of all Nations.

BY REV. STEPHEN D. PEET, EDITOR AMERICAN ANTIQUARIAN.

One of the most interesting subjects of modern study is the traditionary lore of the various races of earth.

There is a wonderful charm in these written and unwritten tales. They are not only poetical and beautiful but often very suggestive. In fact there is a depth of philosophy in them which has made them the subject of study to the most intelligent and thoughtful.

In the three-fold division of mythology, tradition and Folk-Lore, no department of literature is more important. It is, in fact, a department of science as well as of literature, and in its bearings on ethnology and the more general subject of anthropology, it is worthy of profound attention.

It is, however, almost a new and unknown department. Comparative mythology has, it is true, in times past, assumed considerable importance. Not only was this the case in the early days of the Christian era, when the mysteries of the cabiri were the subject of study among the learned, but even after the reformation, when Joseph Scaliger and other writers revived the occult subject.

Later, too, than this, the comparison of the classic mythology with the sacred narrative became a subject of study, and the Abbe Bannier, Jacob Bryant, the Abbe Pluche and others wrote at length upon the topic. Still later, Sir William Jones, in his extensive travels and by his familiarity with so many languages, became acquainted with the mythology and the traditionary lore of Arabia and the East Indies; and still later, the studies of Champollion and Sir J. G. Wilkinson, brought to light the ancient but long buried literature and mythology of Egypt and the regions on the Nile; and the translation of the Edda, and the publication of that charming book, Mallett's Northern Antiquities, also disclosed many delightful pictures, and wonderful myths among the Icelandic Sagas.

The Scandinavian mythology was found to be as poetical and as interesting as the classic, and, in fact, it was discovered that there was a wonderful similiarity between the mythologies of the distant East and the distant West, and that the same stories which had charmed the ears of the Orientalists in their warm sunny homes, were only repeated in the frost-regions of the distant North. If the language was different, the drapery of thought having been borrowed from the different surroundings, yet there seemed to be the same basis of fact.

It was afterward, however, discovered that the American races also possessed a wealth of traditionary lore which was as charming and as striking in its resemblances, as that of the Orient or of the classics, and it was ascertained that the realm of comparative mythology was not confined to the Aryan race, nor even to the Eastern Hemisphere.

Students, as they read the Scandinavian and then the American myths, were surprised at their striking similiarity. Such was the resemblance that the reader was almost inclined to suppose that the Icelandic stories had been carried westward and repeated to the tribes of Aborigines by some pre-historic wanderers, or that some unknown intercourse between the two hemispheres had existed. Thus the volumes of "Algic Researches," by Schoolcraft, were found worthy a place beside the Norse Tales or even the writings of Homer.

Still later there appeared another development of the same great subject. The researches of that remarkable man, Brasseur de Brebourg, threw up before the notice of the civilized world, that wonderful waif of literature called Popal Voh, and it was found, that far to the southwest, among the half civilized races of Central America, there were myths and strange traditions which carried one's mind, not back to the Norse regions, but to the Orient; and again the resemblances between the traditions of the Eastern and Western Hemisphere surprised the students.

The depth and richness of American mythology proved remarkable, and there were beauties and wonders in it almost as striking as those of the Scandinavian or the classic.

It remained, however, for that learned Sanscrit scholar, Max Müller, to show the value of these various collections of myths. In his "Chips from a German Workshop" he has shown that comparative mythology is really as important in the study of mankind as is comparative philology. He has given a comprehensive sketch of the various religions of the East, with their earliest history and development, and has at the same time referred to the many works on the Folk-Lore and Nursery tales of other lands.

He has shown the value of history in bringing to light the earliest religious ideas of mankind, and yet has suggested the necessity of a philosophic and scientific study of the subject. He says, * "History with its dusty and moldering pages, is to us a sacred volume—as sacred as the book of nature. What compels men in the midst of these busy times to sacrifice their leisure to a subject apparently so unattractive and useless, if not the conviction that in order to obey the Delphic commandment—in order to know what man is—we ought to know what man has been."

Now it is this view of the importance of the earliest history of mankind in throwing light upon many of the great problems of science to which we would call attention.

The history of those distant ages and distant men assumes a new charm as

*Chips from a German Workshop, Vol. II, p. 3, article "Comparative Mythology."

soon as we know that it tells us the story of our own race, of our own family, nay! of ourselves.

Many things are still unintelligible to us, and the hieroglyphic language of antiquity records but half of the mind's unconscious intentions." Yet there are many things to be learned by comparing these mystic phrases, and it may be that we shall yet gain an interpretation of these earliest records which will throw a flood of light on the dark problem of man. Even these traditions and beliefs which were at the time not half understood, may in the light of later days, become significant of many important lessons.

There is a deep philosophy even in the unconscious workings of the human mind, and even fragments of thought are sometimes valuable as giving the key to the great arch which is so mysteriously being constructed. It may be that traditionary lore will yet prove to be a sort of universal language among the human race—a language not of words but of conceptions, and that these conceptions have become mingled with the earliest thoughts and views and practices of the various races, and then expressed themselves in their myths.

Nor does it matter whence these traditions sprung, whether from a common historical origin or from the inspiration of nature—the teachings of that great-good mother who teaches all her children alike. It is not essential whether we hold to the opinion of a nature basis for them all, or maintain the Historical origin; the resemblance of these traditions is really the point for us to consider.

We have in this essay, however, taken the position that these resemblances are evidences that there was a common historical basis or origin to them, and yet in taking this position we do not enter into a discussion of the subject with any controversial spirit, but with a sincere desire to know what is the truth.

The difficulty, however, is in the magnitude of the subject; no department of study involves a more extensive and more universal range of reading than does this.

To go over the many volumes which have been written on Folk-Lore alone is a formidable task, and yet no conclusion can be reached except as this field is thoroughly traversed. Max Müller has mentioned many of these, such as Kelley's Folk-Lore, Dasent's Tales of the North, Dasent's Deccan Days, Tales from the West Highlands, Popular tales from the North, Zulu Nursery Tales, and others, and has found in them certain traditions which could be explained on no othe resupposition than that of a common historic origin.

The number of books on this subject is, however, increasing rapidly, and scarcely a periodical appears but that mention is made of some new volume. The researches of antiquarians, the observations of missionaries, the testimony of intelligent travelers and explorers, are constantly furnishing new material.

It is said that Jacob Grimm was the first to mention the importance of collecting all that could be saved of popular stories, customs, sayings, superstitions, and beliefs, and his Dutch Mythology is a storehouse of such curiosities; but since his day it would seem as if every land had been searched for these strange

waifs of literature. Traditionary lore has been gathered from many of the most distant lands, and at the some time the customs of different races have been studied to see what traditional or what historical origin there was to them.

The simplest customs of modern days, such as dancing around the May-pole, the various religious and burial customs, have thus proved to be connected with tradition, and many of the symbols which are so frequently associated with religious forms have been traced back to very early times. The works on this subject are numerous and need to be studied.

There are also numerous books of travels, travels in Africa, in Siberia, Independent Tartary and among various wild tribes and uncultivated nations, all of which it is important to consult.

The works on comparative mythology are also numerous. Many of these are quite recent, such as "Cox's Aryan Mythology," and "Brinton's Myths and Myth Makers of the New World," and others, and yet the various Geographical and Geological Surveys are constantly gathering material for new works. In ancient history, also, a vast and increasing field opens before us, wherein we are to search for the original facts on which tradition is based. Not only are the ancient works of Herodotus, Diodorus Siculus and Plutarch to be consulted, but the later investigations of Rawlinson, Layard, George Smith, Gladstone, Grote and many others.

In the line of comparative religions there are also proofs on the subject, and the works of James Freeman Clarke, "Ten Religions" of Hardwick, "Christ and other Masters," and many others, need to be studied, as well as the older works of Davidson, Prideaux, Smith's Patriarchal Age and Warburton's Divine Legation.

Now, to sift all this vast mass of erudition, and to gather material from the many different departments of history, ethnology, mythology, and to say that we have arrived at definite proofs on this subject would be presumptuous indeed. Grote, the historian, bears witness to "the uselessness of digging for a supposed basis of truth," and Max Müller himself finds it very difficult to arrive at definite conclusions in reference to many of the myths and traditions even of the old world.

In studying the subject, however, we have not undertaken to trace the resemblance of all this vast and varied amount of material. This would be a task for a life-time. The largest part must necessarily be left in its own crude and unclassified condition, and other generations will need to trace the ethnological and the historical lines, or establish the ethnic philosophy which may account for the analogies and resemblances which so extensively appear. There has, however, been suggested to us a way of studying the subject which has at least been helpful and instructive.

It is well known that the Bible is the oldest book in the world, and in reference to the traditions of the ancient races at least, it is very instructive.

In reading the numerous volumes of that rare old work on comparative my-

thology, "Bryant's Analysis," it was represented that there were certain particular facts which were first recorded in the Bible, and which could be recognized in nearly all the mythologies of the East. and it occurred to us that possibly these same points or facts might also be traced in the traditions of other and even distant lands. We have confined our attention then to the earliest recorded facts of the Bible. It remains for us to show that these many resemblances of certain traditions among nearly all races to the scripture account can be explained on no other supposition than that of a common historic origin.

The scientific proof may be wanting, yet we maintain that the various cosmogonies contained in so many different traditions, the universal prevalence of a certain form of tree and serpent worship, the very common tradition of a deluge, and the various traditions of ancestral history and migrations, are all strong proofs that the same facts recorded in the Bible are the basis of the resemblances. We may call the Bible story an allegory, or believe, as Tyndall professes to, that it is a poem; or we may suppose that the processes of nature were the basis of the sacred record itself, yet the similarity of traditions in these particular points will need to be accounted for.

Now, taking into consideration the fact that these were the common inheritance of the Semitic nations of the East found in history, dug up in buried tablets, recognized in mythology, celebrated by poetry, repeated in many of the sacred books, and confirmed by many of the recent discoveries, it seems probable that they also might be transmitted through the lines of emigration, and preserved both by tradition and history in other and distant lands. The very discovery, then, of myths or traditions which bear a resemblance to these records of the East would certainly render the supposition plausible that the Bible itself, or the facts there recorded, were really the basis of these resemblances.

In taking this position we are not undertaking to prove or disprove the authenticity or the authority of the Bible as a religious book, but only as a matter of scientific investigation we consider ourselves at liberty to give this construction to the resemblance.

The cosmogony of the Bible may have been derived from a nature myth, and the serpent and tree may have been the natural objects of veneration and fear; the story of the flood may have been that of a local deluge, like others in other lands; the dispersion may have been an historical event; the confusion of tongues also an event which was inevitable from the growth of society and separation of families; the story of the fall and subsequent woes, and defections, and corruptions may all have been mere national and historical events which are recorded in the Bible in the familiar and yet reverential style; but the question still remains, how came the same facts to be so extensively recorded and by so widely separated peoples.

If these stories of a deluge, of a tree and serpent worship, and of the creation were so similar because each had similar experience, and there were local causes in each which would give rise to the resemblances, still we are at a loss to

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explain why the coincidences should be so numerous and the resemblances so striking. The symbol of the ark and the tree and serpent, and the fish, and even the idols which commemorate these early facts are found too often for us to believe that there was not among the nations of the East at least a common origin for them all, and it yet remains to be shown whether the same symbols are not also to be found in other lands.

So, too, the names of the first ancestors among the ancient nations of the East are significant of the name of the first ancestor who is mentioned in the Bible.

It is not always the case that the record of these nations goes back of the flood, yet generally the head or founder of each nation bears a name which strikingly resembles both in the consonants employed, and perhaps even in the pronunciation, either the Adam or Noah of our Scriptures, and we may suppose all to have orally signified the same person. Among the Greeks, he is Inachus;* in Crete, Minos; among the Etruscans, Minerfu; in India, Tenu; in Egypt, Mna; in Germany, Mannus, and over each nation he bears the same relation as the head of the first dynasty, the first ancestor, and king, and the lawgiver, and in some cases he is called the great navigator and ruler.

Thus, as we enter upon the subject, we are confirmed by the testimony of history and the evidences of archæology, the symbols and records of the oldest nations bearing testimony for us.

It is then among these historical records that we shall seek for our evidences. Other authors have traced these, and Max Müller has gathered many of them into separate volumes of essays and reviews. It is probable that as to the Aryan race, and the various oriental religions, this assertion that the facts of the Bible may be recognized in them will not be really disputed.

Dr. Spiegel, the learned German editor and translator of the Zend Avesta has shown most conclusively that there is a coincidence. He maintains that this resemblance is found in the following particulars: the creation, the garden of Eden, the two trees, the deluge, Noah's ark, and the four ages of the world. The coincidence in the account of the creation consists in this: that the world was created in six days in Genesis and in six periods of time in the Avesta. In Genesis the creation ends with the creation of man; so it does in the Avesta. The Garden of Eden, and the Paradise of the Zoroastrians are alike, and the rivers Pishon and Gihon may be identified as the Indus and the Jaxarties, known to geographers of this day. The two trees in the garden are recognized in the trees known to the Iranians as the "Gaokerena," bearing the white Haoma, and the "Painless tree," out of which the Indians believe the world to have been created.

The deluge is also mentioned, and Dr. Spiegel compares the Thraêtaona of the Persians, who divided his land among his three sons, to the Noah of the Bible. He thinks also that the four ages of the Persians coincides with the four

* Philip Smith's Ancient History, Vol. I, p. 85.

periods of the Bible chronology; that from Adam to Noah being the first, that from Noah to Abraham the second, that from Abraham to the death of Jacob the third, and that of the exile in Egypt the fourth.

Max Müller, in commenting on this view, while often doubting the conclusions of Dr. Speigel, yet shows the coincidences which may be found between these records in the Zend Avesta and the corresponding account in the still older book of the Hindoos, the Vedas.

The account of the temptation and the fall, the tree and the serpent, he acknowledges to be found both in the Avesta and the Vedas, but he maintains that the dualism of the Avesta, the struggle between Ormuzd and Ahriman, or the principles of light and darkness, is to be considered as the distant reflex of the grand struggle between Indra, the God of the sky, and Vitra, the demon of night and darkness, which form the constant burden of the hymns of the Rig Veda. He says, "neither in the Veda or in the Avesta does the serpent assume that "subtile and insinuating form which it does in Genesis. * * * But the serpent that beguiled Eve seems hardly to invite comparison with the much grander conception of the terrible power of Vrita and Ahriman in the Veda and Avesta. He says, also, "We likewise consider the comparison of the cherubim who keep the way of the tree of life, and the guardians of the *Soma* in the Veda and Avesta, as worthy of attention, and we should like to see the etymological derivation of the word cherubim, from the Greek word, *gryphes*, Greifen, and of seraphim, from the Sanscrit, sarpa, serpents, either confirmed or refuted." So, too, of the deluge he says: "It is not mentioned in the sacred writings of the Zoroastrians nor in the Rig Veda, but it is mentioned in the later Brahmans and the arguments of Burnouf, who considered the tradition of the deluge as borrowed from Semitic neighbors seems to us to be strengthened rather than weakened."

Fifty years ago the sacred books of three of the most important religions of the world were not known. It is said that Brahmanism claims for its adherents thirty-one per cent of the population of the globe

The sacred books of the Brahmans, the Buddhists and the Magians or disciples of Zoroaster have only become known since the knowledge of the Sanscrit has furnished a key to their translation. The discovery of these coincidences between the ancient writings of the Eastern nations and the Bible is most remarkable. "There is a high degree of interest attaching to their antiquity, for we seem to have not only the beginning of history but also the beginnings of intellectual life and of religious thought."

But leaving these sacred books of the East and their coincidences, we pass to the accounts of the same facts among the Western nations. Here we are met at the outset with the familiar myths of the Greeks, of the garden of the Hesperides with its fabled tree which bore the golden fruit, and of the dog Cerberus who guarded the tree, and it does not seem difficult to imagine that this was only another version of the same old story. The deluge of Ogyges and of Deucalion also remind us of the same story of the flood. Gladstone says, "Many elements

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of the Hebrew tradition recorded in the Holy Scriptures, or otherwise preserved among the Jews down to later times, appear in the Olympian court of Homer. The traditions traceable in Homer which appear to be drawn from the same source as those of Holy Scriptures are chiefly these: (1) a deliverer, conceived under the double form, first of the seed of woman, and secondly of the logos, the word or wisdom of God. (2.) The woman whose seed the Redeemer was to be. (3) The rainbows considered as a sign of communication between God and man."*

He also says, "Certain special features are traceable most of all in the Athene and Apollo of the Homeric poems, but also in Zeus, and in Leto, and in Iris, as well as one or two other Olympian personages, and these features impart to the pictures of them an extraordinary elevation and force, such as to distinguish them strongly from the delineations of other gods.

The features in themselves are in the most marked correspondence with the Hebraic traditions as conveyed in the books of Holy Scripture."

It is very remarkable that in the Greek mythology these later Messianic ideas should have found a place in connection with these early traditions, yet there does not seem to be any doubt that the story of the garden, and of the woman, and of the seed of the woman, can be traced in the poetry of Homer. But it is probable that the advance of Jewish thought may have had its effect on these productions of the Greek mind which were so much later in time, and yet so near in geographical location, and, therefore, we do not dwell upon these coincidences referred to by Gladstone.

There is, however, a great contrast between the Greek mythology and the Scandinavian in this particular. The latest remnant of primitive heathenism is here found surviving the Greek and the Roman by nearly a thousand years, and yet for symplicity of the narrative and for striking resemblances to the earliest traditions nothing is equal to it. The story of the creation, and of the garden, and the flood as it is found in the Scandinavian myths furnish the most striking coincidences to the sacred narrative. It seems, indeed, like passing over a whole day of history thus to turn from the earliest book of the Vedas to the late date of the Eddas, and from the distant and warm region of the East to the frozen regions of Iceland and the North, yet the story seems to have retained its peculiarities in all its long wanderings.

Iceland was peopled and civilized by the Norsemen in the ninth century. The early emigrants were, however, Pagans, and Max Müller says that their religious system "may be called one of the various dialects of the primitive religions and mythological language of the Aryan race." (Chips from a German Workshop, Vol. II, p. 191.) He says, too, "There are passages in the Edda which seemed like verses from the Vedas." There are, also, several mythological expressions common to the Edda and to Homer.

Mr. Kelly has also drawn the parallelism between the Indian and the Iranian

*Inventus Mundi, pp. 207 and 274.

World tree, and the Ash tree, Yggdrasil of the Scandinavians, the same as Dr. Spiegel between Painless tree of the Persians and the Soma of the Hindoos.

We shall quote fully and literally from the translation of the Edda as found in Malletts Northern Antiquities.

"Many ages before the earth was made, was Niflheim formed, in the middle of which lies the spring called Hvergelmir, from which flow twelve rivers — Gjoli the nearest to the gate of the abode of death."

"But first of all there was in the southern region the world called Muspell. It is a world too luminous and glowing to be entered by those who are not indigenous there. He who sitteth on its borders to guard it is named Surtur. In his hand he beareth a flaming falchion, and at the end of the world shall issue forth to combat, and shall vanquish all the gods and consume the universe with fire. * * * Thus whilst freezing cold and gathering gloom proceeded from Niflheim, that part looking towards Muspellheim was filled with glowing radiancy, the intervening space remaining calm and light as wind-still air. And when the heated blast met the gelid vapour it melted into drops, and by the might of him who sent the heat, these drops quickened into life and assumed a human semblance. The being thus formed was named Ymir, but the Frost Giants call him Orgelmir. From him descend the Frost Giants." * * *

"Thus it is said that when Ymir slept he fell into a sweat and from the pit of his arm was formed a man and woman, and one of his feet engendered with the other a son from whom descend the Frost Giants. The sons of Bor slew the giant Ymir, and when he fell there rose so much blood from his wounds that the whole race of Frost Giants was drowned in it except a single giant who saved himself with his household. He escaped by going on board his bark, and with him went his wife, and from them are descended the Frost Giants." * * *

"Odin may justly be called the All Father for he is really the Father of All, of gods and of men, and to his power all things owe their existence." * * * In the beginning he appointed rulers, and bade them judge with him the fate of men, and regulate the government of the celestial city. They met for this purpose in a place called Idovöll, which is in the center of the divine abode Their first work was to erect a court or hall, where there are twelve seats for themsevles besides the throne which is occupied by All-Father. This hall is the largest and most magnificent in the universe, being resplendent on all sides, both within and without with the finest gold. Its name is Gladsheim. * * That age was named the Golden Age. This was the age that lasted until the arrival of the women out of Jötunheim who corrupted them.

"Of Ymir's flesh was formed the earth; of his sweat (blood) seas; of his bones, the mountains; of his hair, the trees; of his skull, the heavens; but with his eyebrows the blithe gods built Midgard for the sons of men, whilst from his brains the lowering clouds were fashioned. * * * One day as the sons of Bor were walking along the sea beach they found two stems of wood out of which they shaped a man and a woman. The first (Odin) infused into them life and spirit; the second (Vili) endowed them with reason and the power of motion; the third (Ve) gave them speech, and features, and hearing, and vision.

"The man they called Ask, and the woman Embla From these two descend the whole human race, whose assigned dwelling was Midgard. * * *

"The ash is the greatest and best of all trees. The branches spread over the whole world and can reach above heaven. It has three roots. One of them extends to the Æsir, another to the Frost Giants, and the third stands over Niflheim and under this root, which is constantly gnawed by Nidhogg is Hvergelmir."

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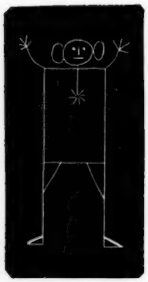
"This third root of the ash is in Heaven, and under it is the Holy Urdarfount. 'Tis here that the gods sit in judgment." * * * "There is an eagle perched upon its branches who knows many things, and the squirrel named Rotatosk runs up and down the Ash, and seeks to cause strife between the eagle and Nidhogg. There are so many snakes with Nidhogg in Hvergelmir that no tongue can recount them."

INDIAN FIGURES IN WESTERN KANSAS.

BY PROF. S. W. WILLISTON, PEABODY MUSEUM, NEW HAVEN, CONN.

For many years the region of the headwaters of the Smoky Hill, Saline and Solomon rivers was a favorite hunting-ground for various tribes of Indians, who have left frequent indications of their picture-making propensities in the carvings scattered over the chalk cliffs. Most of them appear to be descriptive, but some were evidently allegorical and others humorous, or even obscene. The most conspicuous of any that I observed, in company with Prof. Mudge, was on the top of a high mound or hill on the south fork of the Solomon river, about due north of Coyote station. It was shaped as in the accompanying cut, and measured over sixty feet in length by nearly thirty in width, and composed of small cobble stones laid smoothly and evenly. Scattered about over several acres were a score or more of small mounds, built up of stones and not covering any graves.



The object in building these (and the labor had been considerable,) is very problematic; it may have been for amusement, but more probably some superstitious rite, the figure intended to represent some chief, for the sex was strongly indicated.

ASTRONOMY.

ONE ELEVEN-YEAR PERIOD OF SUN-SPOT OBSERVATIONS.

BY WM. DAWSON, SPICELAND, IND.

When viewed through a telescope magnifying about fifty times, the sun is a beautiful object. There must, however, be some means of protecting the eye from the intense light and heat. The best way I know of to do this, without much cost, is to place a kind of cap, having a hole in it about an inch in diameter, over the object-glass. Then put a piece of deeply tinted glass over the eye-piece, when you may look at the sun as comfortably as at the moon. With a six-foot

telescope furnished in this way, I began to make observations on the sun in March, 1867. For several days no spots were seen on the solar disk, but on the 7th of April I saw twenty small spots in three different clusters, or groups. In this observation I used a magnifying power of 200 diameters. And here I would say that a high power requires a larger aperture, or opening, in the cap. I have used a cap with several slides, having apertures for different powers. The slides are round and slightly fastened by one edge to the cap, so they can all be moved and thus get the right size.

With a power much above fifty the sun appears larger than the field of view in the telescope, and hence cannot be all seen at once. I looked at the sun every few days, generally with a power of 100, but saw no more spots till May 24th, when four small spots were seen in one group near the eastern edge of the sun. On the 26th several more spots were visible, two of them being larger and more prominent than the rest. They were also farther from the edge of the sun. By watching them day after day, I observed that they appeared to pass across the sun's disk from east to west—being a visible proof of what I had read, that the sun turns on its axis. One of these spots vanished near the sun's center about the 1st of June; but the other remained very prominent, and seemed very near the west edge of the sun on June 4th. Seeing that a spot traverses the solar disk (one side, or half of the sun) in twelve or thirteen days, we learn that he completes an entire revolution in about twenty-five days—the exact time being twenty-five days and ten hours.

My observations were quite frequent—sometimes every day—through the summer of 1867, and but very few spots were seen, often none at all. In the middle of September a group of fifteen spots appeared near the sun's center, but some of them soon vanished. One, the largest I had yet seen, was at the west edge of the sun on the 20th. It appeared long and narrow—as large spots always do at the sun's edge

Observations were not continued through the winter. On March 8th, 1868, five spots were visible, and on the 15th twenty-five had formed in two groups. Same number on the 18th, five of which were large and prominent, while several were so little as to be just perceptible. But a solar spot must be 400 or 500 miles across to be seen even as a speck. In four days they all had vanished—disappeared before reaching the sun's edge. On the 31st there were two distinct groups, one of them north of the sun's equator, the other south, both containing twenty-seven spots. Near a dozen of these were quite prominent, some of them encircled with a penumbra, which looks like a border surrounding the umbra (black spot). One of these spots was quite large, being of a sharp triangular shape at first, then oval, oblong, etc.

Throughout the months of April, May and June, 1868, from twenty-seven to thirty-four spots were visible nearly every day. For several days in the fore part of July the sun was clear of spots. Eight appeared on the 22d, and 30—all in one group—on the 25th. But few were visible in August or September. On the

22d of October there were ten spots in one group near the east edge, and a single one near the center of the southern hemisphere.

As yet I had seen but thirty-four spots at one time, and that more than five months ago; but now imagine my surprise and interest when, on the 29th of October, I counted 100 spots, with the 100 magnifying power—the one I generally used. Putting on a power of 200, with aperture increased to three inches, I counted 130 spots, arranged in ten groups, three of which were in the southern hemisphere and seven in the northern. I had never heard of more than 200 sun spots being seen at once; so I began to feel much interested to see if future observations would disclose to me a greater number. Seeing but *one* spot on November 8th, gave no encouragement in this direction.

By this time we realize a conspicuous change in the formation and disappearance of sun spots. Small ones sometimes form in a few hours, and vanish as soon. One day a group of little spots is seen; next day it is gone, and a group has appeared in quite another part of the solar disk. The spots in the same group change their positions, and large spots change in shape. And none of these changes are due to the sun's rotation on his axis. They would seem to indicate wonderful commotion and *great storms* on the solar surface.

On the 15th of November, sixty-eight spots in seven groups were visible. A number of observations were made through the winter, none showing more than fifty-four spots, which appeared in three groups January 28th, 1869.

April 7th, no spots visible. On the 11th a group had appeared with about sixty spots, two of which were quite large, but many of them too small and close to be counted with certainty, even with a magnifying power of 200. This power showed 191 spots May 10th. On the 22d but twenty were seen.

June 1st. Here is my number!—215 sun-spots visible to-day with a power of 200. 3d—225 spots in eight groups, one group having 120 spots. 14th—Only twenty-one spots to be seen. But on the 24th the 100 power showed 192 spots in thirteen groups. A power of 200 would probably have shown near 300 spots. I reckon this to be the climax for 1869, at least no subsequent observation showed nearly so many spots. Observations being less frequent during the winter months, it is possible that such a display might have passed unobserved.

After February 4th, 1870, observations were very frequent to the last of August—sometimes every day. The increase in the number and size of the spots was so great month after month that I always felt a wish to see and record the greatest display. Although the average increase in number was so much, yet the occasional disappearance or falling back in numbers was still prominent. Some examples (with power 100) are: February 10th, 1870, 107 spots; 13th, 100; 23d, 18; March 2d, 120; 18th, 154. No fewer than 100 were observed this month. On April 4th I counted 242 spots in nine groups, and on the 17th thirty-two spots were all I could see. On the 24th, 126 were counted. May 15th, 275; June 1st, 76; 13th, 86; 18th, 226; 19th, 349; 21st, 382; 27th, 472, one group having 275 spots.

These numbers were seen with power 100. I sometimes put on a power of 200 and could see about half as many more spots, and when the air was very good, nearly twice as many. But the display on August 27, 1870, exceeded any other that I have ever seen. The hundred power showed 640 spots; and with the 200 eye-piece I counted the astonishing number of 950 sun spots! and the air was not very good either; if it had been, I am fully convinced that *one thousand* spots might have been distinctly counted. There were fourteen groups, one of which had 340 spots; another, 300. But what a change soon followed! On September 11th, *thirty-one* spots were all I could see with power 100; On the 21st, I counted 460 spots in six groups; on October 23d, near 300 were counted in eleven groups. I perceived that the number was growing less, and partly through fear that so much intense looking at the sun might injure my eyes, I discontinued a regular count of the spots; but I still made frequent observations on the number and comparative size of the groups.

For many months the groups continued as numerous as they had been; but they were much smaller, and the number of spots not so great. But the spots occasionally appeared by the hundred for two or three years. For instance, August 17, 1871, there were nine groups; five were small, one large, and three very large—the number of spots being nearly 400. Again, May 5, 1872, fifteen groups, eleven small and four large, with about 200 spots. March 11, 1873, there were eleven small groups and one large group. May 20, 1873, my record reads: "One *little* spot on western side of the sun—the least show of sun-spots I have seen for several years." On May 6, 1874, were one small group and three large ones. In two days they were "three small and one large." April 4, 1875, "two or three little groups." July 22, 1876, "but few sun-spots lately." A few in 1877, though often none at all. About fifty observations were made in 1878, none showing any spots except those on February 6th, March 15th, May 21st to 28th, June 23d, November 3d and 22d, and the passage of a large spot, nearly 5,000 miles in diameter, across the the sun, from September 1st to 13th.

By this time we are forcibly struck with a very prominent and singular fact connected with sun-spots, namely, their *periodical recurrence*, which occurs about every eleven years. If my idea is correct that the maximum of the period just passed occurred about the last of August, 1870, it would seem that the time from minimum to maximum is much shorter than that from maximum to minimum; for, at many times in 1867 no spots were visible, by which I infer that to have been about the time of minimum, or least show of spots, and the beginning of another period, which probably has just closed, or is about ending. (Late observations show no increase of spots, but I am watching for them.)

This paper would be incomplete without a more definite account of the largest spots, many of which were visible to the naked eye (protected by a shade glass). The first one thus seen in this period, was on April 18, 1870. It was of an oblong shape, and, by careful measurement with a glass microneter of 200 lines to the inch, was 14,000 miles wide and 21,000 miles long, the penumbra

being nearly round, and 35,000 miles in diameter—near 1-24 of the diameter of the solar disk. The next spot seen without telescope was on May 15, 1870. On the 18th, two were visible, one of which the telescope showed to be composed of two separate spots. They were much smaller than the one seen a month ago. On June 6th, two spots were visible to the naked eye; another on the 27th, others on July 17th and 31st; one on August 18th; September 21st three spots were visible without the aid of a telescope; one of these was nearly 30,000 miles long and 12,000 wide. This spot had a very singular shape, which I have preserved in a small drawing. Two other spots were seen by the naked eye this year (1870), namely, October 23d and December 4th. In 1871, about twenty sun-spots were visible to the naked eye—sometimes three at once, on different parts of the solar disk. In 1872, but few were so observed—none after 1874. From a number of observations, I conclude that, to be seen with the naked eye, a sun-spot must be about 8,000 miles across. The large spots not only change in form and size, but sometimes divide into smaller ones.

A number of drawings were made from 1867 to 1871, showing the outline appearance of the groups and spots over the face of the sun. Occasionally a large spot is seen without any other one near it, but to see a little spot alone, is quite uncommon, there being nearly always three or more in a group.

The spots are nearly always found in the equatorial regions of the sun, being seldom or never seen more than half-way from the equator toward either pole.

I have not, in my observations, discovered anything bearing on the *cause* of sun-spots. Indeed, this is a subject not yet known to astronomers. The object of this paper being simply to give results of my own observations, the various theories which have been proposed, are left for another occasion, and perhaps a more competent writer.

ON SOME RECENTLY DETERMINED METEOR SHOWERS.

W. F. DENNING, F. R. A. S.

The following meteor showers comprise a few of the most important systems observed or deduced from the catalogues of foreign astronomers, by the writer, during the last three years. The number of meteors conforming to each center is given, and in some cases I have pointed out more than one epoch of intensity of the same radiant, (though not necessarily of the same shower). The aggregate number of meteors that I noted during habitual watches was 4513, (in 429 hours,) and 3213 of these were projected (as observed) on a globe of 18-in. diameter, the radiants derived, and the R. A.'s and Dec.'s of the paths read off and catalogued. In cloudy weather, and during periods of moonlight, I projected many of the meteor paths registered in the extensive lists of Heis, Weiss, Zezioli, Konkoly, and the Catalogue of the Italian Meteoric Association (1872). The number of paths thus examined and aligned was about 11,400. The star charts

used in this investigation were those of the British Association Luminous Meteor Committee, and many of the resulting radiants were found to coincide with those I had myself observed. For the most part they appear to be remarkable more for their long continuance than for transient intensity, and apparently comprise a different order to such condensed streams as the Perseids, Leonids and Andromedes. Several of the best showers, either new or but slenderly supported by other observers, are here pointed out as requiring re-observation during the last half of the year. I have not included already well investigated streams which have been more or less abundantly confirmed. To quote four examples:

	Pos'n deriv'd in 1876-8.	No. met's	
Orionids . .	91° + 17°	147	Oct. 15–31.
Taurids I . .	61° + 20°	182	Oct. 12–Nov. 23.
Gemellids .	110° + 24°	82	Oct. 12–Nov. 20.
Geminids . .	107° + 34°	99	Nov. 21–Dec. 21.

The chief work of meteor observers in the future will be to determine the duration of these and other showers. Opinion is at present divided on the subject, for while theory teaches us that they cannot last but for a few nights, observation proves that they often continue for a month, and sometimes for two months.

The important question is, Are there any showers of such long duration, and, do they belong to one and the same stream?

1. R. A. 32°+53°, (88 meteors,) July 20—Aug. 2. Maximum, July 30—Aug. 1. A very rich shower of short and swift streak-leaving meteors well seen in 1878. Heis gives a position at R. A. 37°+48°, (37 meteors,) July 19—Aug. 2, which is probably identical The meteors of this stream precede the Perseids of Aug. 10 (R. A. 44°+56°), and is evidently a distinct system, though it has no doubt been mistaken for the major shower, and has given it a much longer duration than is really the case. There are a few of the true Perseids visible before Aug. 5 or 6. The new shower near χ Persei may be termed Perseids II., and it is worthy of note that in Oct. there is another radiant at this point.

2. R. A. 341°—13°, (54 meteors,) July 21–31. A well defined shower of rather slow, long meteors, without streaks seen in 1878. It had been previously traced by Tupman in 1869, July 27—Aug. 1, with a radiant at R. A. 340°—14°, (61 meteors). This system forms a prominent shower at the end of July, (maximum 27–30, and in conjunction with the Perseids II. makes this epoch a special one for many shooting-stars.

3. R. A. 70°+65°, (98 meteors,) July 25—Aug. 12. This shower was independently found by Heis and myself. It is close to the small star, c (Bode) Camelopardalis. Heis gives the center at R. A. 73°+63°, and traced 152 of its meteors between Aug. 7–12.

4. R. A. 96°+71°, (106 meteors,) Aug. 6–13. This shower and the preceding one were detected by the projection of more than 700 paths (directed from radiants eastward of the Perseids) in foreign catalogues, and was the chief

center indicated. It forms an active display, but had been overlooked by Heis and others, who had, however, recorded many of its meteors. The forerunners of this shower are visible at the latter end of July, and there is a radiant at the same place Oct. 28—Nov. 7.

5. R. A. 61°+37°, Aug. 6–12, (59 meteors); Sept. 7–15, (34 meteors); Oct. 20—Nov. 14, (43 meteors.) A series of active, well defined showers from a point below Epsilon Persei. The positions are severally confirmed by Heis, Aug. 12–19, at R. A. 64°+39°, (16 meteors); Zexioli and Tupman, Sept. 7–15, R. A. 63°+36°, and A. S. Herschel, Nov. 6, 1869, R. A. 62°+37°, (a fireball). It gives a fine shower of bright streak-leaving meteors at the middle of September. There is another shower at R. A. 62°+48°, apparently sustained for an equally long period, and showing a well defined radiant quite separate from the foregoing. No less than 193 meteors conform to the latter shower, and its chief activity is from Aug. 6–12, and Oct. 20—Nov. 13.

6. R. A. 306°+54°, (31 meteors,) Sept. 1. Meteors have often been observed to be numerous and brilliant on this date. A careful reduction of the observations has led to the determination of a strong radiant N. of Alpha Cygni. 15 of the 31 meteors conformable to it were of considerable brightness.

7. R. A. 102°+48°, (61 meteors,) Oct. 15—Nov. 13. Well observed 1877. The exact center is uncertain. There may be two showers here at R. A. 105°+51°, and R. A. 98°+45°, and more observations are required to settle the point. It is a rich radiant, giving very swift, short meteors in the mornings of October, and it again becomes a center of divergence on Jan. 1–15, Apr. 1–12. For the latter epoch, I find a good radiant of brilliant meteors at R. A. 106°+46°.

8. R. A. 142°+28°, (50 meteors,) Oct. 15—Dec. 12. On the mornings of Oct. 16–19, 1877, a few meteors (including one stationary) leaving bright streaks were observed from a point near Epsilon Leonis at R. A. 140°+28°, and the same point was amply confirmed on the two ensuing months by the directions of the meteor paths, in foreign catalogues. The maximum probably occurs early in November, and its meteors must be dis-associated from the Leonids. Schmidt is the only observer who had detected it before, for he gives a center at R. A. 140° +23°, Oct, 19–27, which is, however, 5° S. of the true radiant point. This stream is evidently of very long duration, and must not be confused with other systems close to it, at R. A. 132°+20°, (69 meteors,) and R. A. 120°+15°, (33 meteors,) which also appear to supply many shooting-stars during the last two months of the year

9. R. A. 43°+22°, (69 meteors,) Oct 20—Nov. 13. Maximum Oct. 31—Nov. 4. This shower vies with the Taurids I. in intensity and in the splendor of its meteors. It was traced by me in 1877, and described as a rich shower of bright, slow moving meteors, distinct from the Taurids, though very liable to be confused with them, for they come near together in date and place. Many large meteors have been seen during the first few days of November, and a projection

of their apparent paths show them to have been chiefly directed from this radiant point. Greg's shower at R. A. 43°+26°, Oct. 18—Nov. 14, is no doubt identical with this, but its importance has only lately been recognized. This may be the same as an October shower at R. A. 46°+27°, (25 meteors); and there is a display of long pathed meteors from the latter point, on the mornings of the early part of August.

10. R. A. 81°+23°, (53 meteors,) Nov. 22—Dec. 21. Maximum, Dec. 6. Taurids II. observed in 1876. The meteors are bright and slow moving. They were reöbserved by Sawyer, in 1877 and 1878. In September and October, this same radiant at Beta-Zeta Tauri is clearly indicated as a shower center of some importance, R. A. 80°+22°, (47 meteors,) and both Zezioli and Tupman traced it; the former at R. A. 84°+21°, Oct. 12–31; and the latter at R. A. 78°+23°, Sept. 8–10.

Bristol, England, Feb. 14, 1879. —*Science Observer.*

GEOLOGY.

ON THE ORIGIN AND FORMATION OF COAL.

BY PROF. E. L. BERTHOUD, COLORADO SCHOOL OF MINES.

The term, "coal," was first used in a restricted sense, meaning glowing embers of wood, then charcoal itself. To-day we mean by "coal" any mineral fuel that will ignite and burn with flame and incandescent heat, whose component parts are carbon, hydrogen, oxygen and nitrogen mixed with small amounts of earthly or mineral impurities; but in all the amount of carbon generally exceeds all other constituents of the mineral coal.

At first, in geological works forty or fifty years since, the "true coals" as they were called then, were supposed to be found only in the carboniferors formation—all coals found either below or above these "coal measures" were looked upon as either adventitious and accidental deposits, or, when found in formations above the "carboniferous," considered as "lignites." These arbitrary divisions have been found untenable, and to-day we know that true coal not only exists in formations older than the Carboniferous strata but also in the Jurassic, Permian, Cretaceous, and lastly in the Tertiary formations of such extent and magnitude as to exceed vastly in amount all the coal known to exist in all the strata beneath it.

Not proposing, in this lecture, to go into a chemical criticism on the subject of all the varieties of coal, I will simply state, that with many others I do not believe in the classification or appellation of our Colorado coal as a "lignite coal."

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I think this is a misnomer which tends generally to cause many scientists east to condemn our coal for certain purposes, or even as a good fuel for heating purposes, from the misleading nature of this conventional name. Being found only in the Cretaceous and Tertiary formations lying at the foot of the Rocky Mountains, the first explorers of our Western Territories educated to compare our products, our minerals and our geological formations with European examples, and finding that in the Cretaceous and Tertiary formations of Europe, all mineral fuel found there, exhibited but a very slight change from the condition of woody fibre, and affording but an inferior fuel at the best, which is called there "lignite," or "brown coal," they jumped at the conclusion that all our recent coals are nothing but "lignites," and therefore they cannot yield a good fuel fit for all the purposes to which coal can be applied.

I am happy, however, to state to my hearers that this assumption is for the most part gratuitous, and not founded upon strict fact or experience. Our coal formations at the east base of the Rocky Mountains are found immediately following the end of the Cretaceous formations, having been uplifted and subjected to intense pressure vertically and horizontally and to heat also; the original form of the simple deposits of vegetable matter, whether as peat or as annual plants or forest trees, or a mixture of all these together, have undergone full as great a change in quality as the coals of the so-called true coal measures or even the Anthracite of Pennsylvania, in other words we can call it a "Metamorphic coal."

For convenience, a division of mineral coals has been proposed, into three classes: "Hydrogenated" or "Coking Coals;" "Oxygenated" or "Non-Coking Coals" and "Hydrated Coals." Hydrogenated coals are such as form "coke" when properly heated in ovens, and derive this property from the presence of a large percentage of hydrogen; yet, if eight or ten per cent. of oxygen is present besides, it loses this quality. Pennsylvania and Ohio bituminous coals with Illinois coals form, in all cases good coke. Anthracite and our Rocky Mountain coal are not coking, while the Permian and Jurassic coal of Virginia is not only coking coal, but from the presence of intruded dikes of trap rock some of the beds are changed into natural coke.

Oxygenated coals, to which our Rocky Mountain coals belong, although affording an excellent fuel, yet, cannot be transformed into coke or pure carbon, for abounding in volatile ingredients the coal burns freely, but does not melt together and cake up as the hydrogenated coals uniformly do.

The term, "hydrated coals" is given to some varieties of mineral fuel that contain a large percentage of water. Even the anthracite of New England has been found to contain up to fifteen per cent. of water. Our Rocky Mountain coals, especially those that have not been exposed fully to heat and pressure, and found away from the mountains, contain a much larger amount of hygroscopic water than those we find uplifted and altered by internal heat.

That our coals in Colorado with the exception of Trinidad, and Gunnison River and White River coal, are all oxygenated coals is one reason why so little

success has attended all trials of such fuel for the manufacture of illuminating gas. To make illuminating gas requires hydrogen and free carbon in large proportions, hence an oxygenated coal cannot give good illuminating gas.

In addition to the above classes of coal we have Albert coal or Albertite, Torbane coal or mineral, Ritchie mineral and the White River Coal of Colorado. These several minerals of great value for gas purposes are more properly, like bitumen, asphaltum or solidified petroleum, to be ranked as coals. They are true hydro-carbons, forming a link in the sequence of Carboniferous minerals of which rock oil, petroleum and naphtha form different qualities, the other end of the carbon scale being Diamond, Graphite or Plumbago and Carboniferous Shale.

The formation of coal and the manner in which this mineral fuel under whatever shape we find it, has been deposited among stratified rocks is yet an unsolved problem. Though the coal measures of the world have for over a century, been studied and examined, and many well established points have been developed, it is as yet an unsolved problem of peculiar difficulty.

Some eminent geologists have established theories and argued on hypothesis founded on known present conditions of temperature, atmosphere and elemental action, thinking that all past processes and agents must, in the primeval age of the earth have been as now of like amount and effect. Others, however, with whom your lecturer agrees, consider that the past state and condition of the earth were very different from those of our present age, and found their reasons on scientific and geological facts no less evident than those holding their opinions from the deduction of the former theories. Altogether, the disagreement between the two classes is much in excess of their agreement on many undisputed points. We will now give an outline of a few of the more prominent theories of the formation of coal beds:

FIRST—The Drift or Raft theory.

This supposes that in those geological ages such as the Devonian, Carboniferous, Permian and Tertiary ages; the majority of the vegetation of the earth grew in wet swamps or low shores of lakes and rivers, or in the low lands of those periods; that this vegetation, torn loose and transported or drifted by waves and currents into shallows of the sea, or in lakes, was deposited on the bottom, thus forming, by continued additions, our present coal beds. All this presuming that vegetable matter thus sunk would not decay, and that the mud which invariably accompanies such drifting material would not mix with the submerged woody matter.

The advocates of this theory pointed triumphantly to the present immense accumulation of wood formed at this day in the delta of the Mississippi, and the Red River raft accumulation still increasing. If this theory were true, and the age of the delta of the Mississippi is as some claim, over 30,000 years; the first deposits of the delta would be "lignites." So far none have been found at the surface or by boring down hundreds of feet. This theory is now obsolete.

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SECOND—Peat-bog theory:

That originally coal was composed not only of land-plants, but that large peat-bogs or marshes, slowly accumulating for centuries, were finally covered over and filled up by changes in level of the earth caused by earthquakes, or movements of elevation and depression; that thus covered by the sea, a succession of rocky or sandy or muddy deposits covered these ancient marshes and formed our coal basins; that several such alterations of level took place, each accompanied by a new coal deposit, to be in its turn covered again by the gradual erosion and dispersion of land formations caused by the action of the sea. Admitting the possibility that the growth of vegetation took place, as claimed in this theory, the alternate elevation and depression of the sea is too unnatural to be received as a geological fact.

THIRD—The Marine theory:

Supposes that the vegetation of the primeval world grew either in the sea as sea-weeds, or in shallow water; that their roots grew in the fire clay of the coal measures; that the water abounded in carbonic acid, or, even hydro-carbon; that a high temperature and greater internal heat was most favorable to plant-growth and caused great uniformity of seasons, while the atmosphere, redolent with smoke, steam and vapor, permitted but little effect from sun-heat; that, under those conditions, vegetation grew rank, profuse and of wondrous rapidity. Thus the presence of hydro-carbons, juices and sap was evoked to form coal in which vegetable fiber has only a secondary part. Prof. Lesquereux has advocated the theory that sea weeds are the original source of the vast coal-oil deposits of Pennsylvania, and the United States, generally; that originally the vast sea-weed forests of the ocean were covered by deposits; that the effect of heat and pressure has transformed the cellular matter into liquid hydro-carbon.

FOURTH—Petroleum theory:

That when, as in the third theory, the beds of vegetable matter under water were subjected to pressure, the hydro-carbon oils would be squeezed out of them, then float on the surface among the growing plants, would aid to preserve them; this, becoming heavier from dust, mud, evaporation and oxidation of vegetation, would continually add to the volume of the coal-bed below the level of water. We think this theory is somewhat forced and of too refined a possibility.

The fifth and sixth theories are linked together under the name of Mineral and Volcanic theories:

In the Mineral theory it is attempted to account for and prove the formation of petroleum and its resultants coal and bitumen from chemical decomposition of water caused by the heat of submarine volcanoes and currents of hot, molten lava disengaging carbon, and that the petroleum or bitumen thus formed aided in the production of coal, although the formation of these two hydro-carbons did not require vegetable fibers for their formation. Messrs. Dadow and Bannan maintain this opinion.

The Volcanic theory, which is the last one, does not so much relate to the

formation of coal as to the manner in which the alterations of stratification in coal-fields were caused; but, as this covers nearly all known geological science, we will not attempt to give it in full. We may concisely state that all these theories contain elementary facts; that perhaps all the above causes cited may have had a part in the formation of coal, but that we cannot take any one theory and bring all the facts of coal formation deposits within the area of its hypothesis.

Ever since the existence of coal formations have been demonstrated to exist within several degrees north of the Arctic circle; that coal measures and accompanying fossils are found north of 66° of north latitude; that the existence of lignite beds in Greenland, Iceland and Spitzbergen, on Mackenzie river, in Alaska and in the circumpolar lands north of Behring's Straits, another difficulty has been added to the previous perplexing questions involved in the explanation of the formation and deposit of coal.

This is the question of terrestial temperature, then and now, and how to account for the anomalies involved by the existing present state of the globe compared to its former state, when, from fossil evidence, we find palms, magnolias, pines, redwood, sassafras, sweet-gum and other trees growing formerly in Greenland, Spitzbergen and Iceland, when we find fossil shells and corals that require 66° mean sea temperature, now fossil on the Arctic sea-shore, and derived from carboniferous strata. These instances, and the direct proof that far within the Arctic circle once roamed vast herds of elephants, mastodons and wild horses, with animals akin to our buffalo, deer, musk oxen and domestic oxen, proves beyond doubt a change as vast in temperature as in animal and vegetable creation.

So, then, if we adopt Prof. Dana's theory of the presence in the water and atmosphere of an excess of carbonic acid and carbonic acid gas; that we, perhaps, in the Devonian and Carboniferous Ages had then a greater measure of internal heat from the as yet unadjusted and balanced cooling of the external crust of the earth; that the low elevation of the then dry land, the prevalence of vast sheets of fresh water in shallow lakes, the presence of and the tempering influence of great seas had a very material part in stimulating plant-growth; that their preservation and transformation into coal was aided by the presence, then, of great quantities of rich hydro-carbons, and the continuance, for untold ages, of this condition finally resulted in our present coal beds and coal measures. Willing, perhaps, to accept these as good, probable causes for the deposit of all coal measures known, yet this theory does not give us full conviction, as it asks us to accept tacitly a condition of terrestrial and atmospheric differences incompatible with our present known data of temperature, latitude and the seasons. In other words, it seems to ask our full belief in a past condition of things terrestrial, incompatible with all present known laws from which we must derive some points of analogy and comparison, asking us to accept the idea of an almost universal average of sub-tropical temperature as ruling the earth from the Devonian until the end of the Tertiary, and that, too, far within the Arctic circle, with no explanation of such assumption.

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In some future lecture we will take up this subject and endeavor to reconcile these anomalies by including in our theory not only the coal measures of the earliest ages, but also applying to the latest Tertiary coal measures the same ratio of foundation.

GEOLOGY OF LA GRANGE COUNTY, INDIANA.

BY E. S. EDMUNDS.

II.

To write the geological history of a county so as to make it interesting to the scientific as well as the general reader, is a task that requires a great amount of study, together with critical and thorough investigation of the subject.

A professional geologist being acquainted with the structure of the earth's crust, and from "the testimony of the rocks," writes more boldly and perhaps with much less mental fatigue than the amateur, who, with cautious steps feels his way along through the various geological eras with the assistance of his boon companions—his books.

It is not a difficult matter to investigate and determine the rocks of any particular period, when they are disclosed plainly to view and the tangible evidence proves, beyond the shadow of a doubt, their identity. But, to judge of the underlying rocks when covered by a drift two hundred feet deep, is quite another thing.

The great problem, regarding the earth's growth, has puzzled the brains of mighty intellects, and is still a matter of much speculation(?). "Geology," says a noted writer, "is yet in its infancy." We realize the weight of this truthful statement, when we attempt to peer backward into the dark labyrinths of "chaos," and follow the history of our planet up through its paroxysmal struggles for existence to the present time. What, then, can be our conclusions when we find that the theory upon which we have based our fondest hopes, is crushed to atoms?

Notwithstanding the changes that are constantly taking place in the scientific world, we must acknowledge the opinion of the world's great leaders. Then, as geologists, we must accept the principles laid down by Lyell, Dana, Murchison, Agassiz and others, who have formed their theories upon close and accurate observations, backed by years of hard labor and care

Beginning with the Mesozoic, or Mediæval, Age, we find many interesting fossils. Of this age, Prof. Dana fitly remarks: "The age of reptiles is especially remarkable as the era of the culmination and incipient decline of two great types in the animal kingdom, the Reptilian and Molluscan, and of one in the vegetable kingdom, the Cycadean It is also remarkable as the era of the first Mammals—the first Birds—the first of the common or Osseous fishes—and the first Palms and Angiosperms."

This age is divided into three periods; named in the order of formation: Triassic, Jurassic, and the Cretaceous or Chalk period.

It is presumed that the reader is cognizant of the origin of the above names, but, to make the point more plain to the general class of readers, I will explain the meaning of the terms.

The Triassic (triple), takes its name from the fact that in Germany it is composed of three distinct groups. The Bunter Sandstein or colored sandstone, the Muschelkalk or mussel chalk, a miner's term, meaning a group of red and green marls and shells. It is sometimes termed the new Red Sandstone, to distinguish it from the old Red Sandstone of the Devonian.

The Jurassic period derives its name from the Jura Mountains, on the western borders of Switzerland, one of the regions characterized by the formation.

The Cretaceous period derives its name from the Latin *creta*, chalk. The chalk, of England and other portions of Europe, is one of the rocks of the period. Says Prof. Dana, "The Triassic continent spreads westward to Kansas, and southward to Alabama. While on the east, the continent probably stood above its present level, through this period, and while, over much of the Rocky Mountain region, the land was barely emerging from the waters, or was covered by interior salt seas, farther west, over a large part of the Great Plateau, and the rest of the Pacific slope, the surface was washed by the Pacific and peopled with its life. The Sierra Nevada was then no barrier to the ocean; for the sands, mud, and limestone accumulated in those waters, constitute some of its rocks. The stratified beds of the mountains were then in the progress of formation, through the action of the Pacific tides, currents, and waves, and the growth of marine life. The making of the Sierra was delayed till the rocks of still another geological period had been deposited upon the Triassic."

The fossils of this period are not abundant in this vicinity. I will, however, mention a few only. Of the Cephalopods: the *ceratites nodosus*, a quaint-looking fossil, resembling more nearly a long, tapering worm rolled up into a wheel, the smallest part being rolled into the center. Specimens of the Orthoceras—similar to the Devonian type—are to be found occasionally. Ostracoids: *estheria minuta*, a very small shell-animal, which must have been an easy prey to the many monsters then inhabiting the Triassic Sea. With this small list of fossils, which is all that I have been able to identify, I pass to the Jurassic period. Its plants were mostly of the land and were mainly ferns, conifers and cycads, something like the Triassic. I have in my possession a fossil containing some of the stems of the ferns of this period.

The animal life of this epoch is quite well represented in the rocks of this region. Oölites sponge—*scyphra reticulata* were the most abundant of this family. Of the Polyp Corals of the Oölite, *Montlivaltia caryophyllata* and *Prionastraea oblonga*, two corals resembling somewhat the Polyps of the Devonian and Silurian periods. Of the Lamellibranchs of the Lias, the *Leptaena Moorei* and *Spirifer Walcotti*; and of the Oyster family of the Oölite, *Ostrea Marshii*,

Gryphæa dilatata—the former, Ostrea, is said to have been the progenitor of the common oyster, which bivalve is held in such great demand. The remains of Gasteropods, *Ammonites Humphreysianus*—similar to the Triassic fossils—are met with occasionally.

Of the sub-kingdom of Articulates, specimens of various worms, crustaceans, spiders, &c., are found. A crustacean, closely resembling the *Eryon Arctiformis* of the Oölite, is occasionally seen. This curious looking animal had a body something like our crawfish of to-day—with formidable pincers and a hard, bony-cased head. None of the larger class of animals of the Jurassic—Ichthyosaurus, Plesiosaurus and Pliosaurus, etc., are found, but, in connection with this period, I will describe briefly the above denizens of the Jurassic Sea. The *Ichthyosaurs*, (the name, from the Greek, signifying fish-lizard,) were gigantic animals, ten to forty feet long, having paddles somewhat like the whale. It had a long head, whose lower portion of which was armed with formidable-looking jaws, containing, in some species, two hundred stout, conical, striated teeth. This terrible creature also had an eye of enormous dimensions—in one species the orbital cavity being fourteen inches, in its longest direction—this eye, also, had a peculiar construction, to cause it to act both as a telescope and microscope, thus enabling the animal to descry its prey deep down in the water, and in the night as well as day. The length of the jaws was sometimes more than six feet. Its skin was naked, some of it having been found in a fossil state; its habits were carnivorous; its food, fishes and the young of its own species—some which it must have swallowed—were several feet in length. The *Plesiosaur* (the name meaning allied to a Saurian) had a long, snake-like neck consisting of from twenty to forty vertebræ, a small head, short body, with paddles similar to the *Ichthyosaurus*. Its paddles were proportionally larger than its prototype, no doubt for the purpose of greater speed in the pursuit of its prey. It was an inhabitant most probably of the shallow arms of the Jurassic Sea, where it probably used its long neck for seizing fish beneath, and perhaps flying reptiles above the water—of which there were many kinds.

Leaving the Jurassic, we enter the Cretaceous (Chalk) period, which is the closing era of the Reptilian Age. It is remarkable for the number of genera of mollusks and reptiles which end with it; and also for the appearance during its progress of the modern types of plants. This period is divided into two epochs—Earlier and Later Cretaceous. The rocks of this period "occur (1) at intervals along the Atlantic border, south of New York, from New Jersey to South Carolina; (2) extensively over the States along the Gulf border; thence bending northward along the Mississippi Valley, beyond the mouth of the Ohio, over what was then a great Mississippi bay; (3) through a large part of the western interior region, over the slopes of the Rocky Mountains, from Texas northward to the headwaters of the Missouri, and westward through Dakota, Wyoming and Utah Territories and the State of Colorado; along farther west, through some parts of the Colorado Valley, but not over the plateau between the Sierra Ne-

vada and the Wahsatch Range; (4) along the Pacific border, in the coast ranges west of the Sierra Nevada; (5) in British America,* on the Saskatchawan and Assiniboine; also, (6), on the Arctic Ocean, near the mouth of the Mackenzie, and in North Greenland. On the Atlantic border they are unknown north of Cape Cod."—DANA.

Although the fossils of the cretaceous are found in this locality, yet there are no rocks of this formation in considerable quantities nearer than Fort Dodge, Iowa, where it crops out prominently. Being of a soft nature, it is easily carved, and many beautiful ornaments are made. The station-house, or depot, at the above city is built of this material.

"The cretaceous rocks comprise beds of sand, marlite, clay loosely aggregated, shell limestone, or 'rotten limestone,' and solid limestone. They include, in North America, no chalk, excepting in Western Kansas, where, 350 miles west of Kansas City, a large bed exists."—*Dana.*

Judging from the fossils of both the fauna and flora of the cretaceous period, there seems to have been a decided change in the vegetation of the continent. While there yet remained the cycads (plants between the palms, ferns and conifers), of the Triassic, Jurassic, they were contemporaries of the "first yet known of the great modern group of angiosperms," such as the oak, maple, willow, and the common fruit trees indigenous to the temperate regions, inclusive of all trees having a bark but the conifers and cycads. Of the angiosperms, fossils of the *Sassafras cretaceum, Liriodendron meekii, and Salir meekii* are found.

Not wishing to dwell longer upon the flora, I will describe some of the cretaceous fauna among the protozoans of this epoch. The most important fossil is a rhizopod, *Orbitolina Texana.* This species are disk-shaped, closely resembling some of the nummulites. Under the sub-kingdom of molusks, the most common brachiopods are of the terebratula family, *Terebratulina plicato* and *Terebratula harlani.* The most predominant genera of samellibranchs are three of the oyster family, *Ostrea larva, Gryphaea vesicularis* and *G. pitchere*; also, another conchifer, *Inoceramus problematicus.* A limited number of the gasteropod family, *Pyttfussus nerolerryi* and *Fasciolaria buccinoides*, are occasionally to be found. No fossils of the largest type of animals of cretaceous origin are found in this locality. Although this fact is apparent, yet there are some fossils belonging to this period that I think should be mentioned in connection with what has been stated before. Among the denizens of the cretaceous existed huge and formidable monsters—*Enaliosaurs*, or sea-saurians, belonging to the reptiles. These were exceedingly numerous. They were provided with flippers, with which they propelled themselves through the water with wonderful speed. One species of these animals, called by Leidy *Discosaur*, was fifty feet in length. It had a neck of over sixty vertebræ, measuring over twenty-two feet from one extremity to the other. The *Mosasaur*, a great swimming snake-like reptile, literally one of the "sea-serpents" of the era. Says Dana: "Remains of over forty American cretaceous

*It is quite probable that the fossils of the Cretaceous period, found in our vicinity, may have been brought in the drift from this locality (?) or at least some of them.

species of this tribe have been found—about fifteen in New Jersey, six or more in the Gulf beds, and over twenty in Kansas; and one of them, at least, *Mososaurus princeps*, was seventy-five to eighty feet long. The first one known was found in Europe, near the river Meuse, and hence the name. The body was covered with small, over-lapping, bony plates. The paddles, of which there were four, had the regular finger-bones of *man.*" Horrible thought! that we should have a characteristic of such frightful looking monsters as these lizard-demons of the deep!

I have only space to speak of one more of these terrible animals. The *Laelaps* was a powerful carnivorous animal, and the destructive enemy of the preceding smaller reptiles. A full-grown specimen was probably twenty-five feet in length. Its toes were long and slender, like those of a bird of prey. They were armed with flattened hooked claws ten or twelve inches long and adapted to grabbing and tearing. Its teeth were curved, knife-shaped, saw-edged, and fitted like scissors for cutting. The tail was long, rounded and strong, and capable of striking a blow or of throwing an enemy within reach of the kick or grab of the terrible hind leg.

What must have been the scene, could mortal eyes have gazed upon both land and sea during the Mesozoic Age? Prof. Stelle fitly describes it in his *Scenic Description* of the landscape of this age thus:

"It is an arm of the ocean, with broad, flat, muddy shores, at the bottom of which is gathering a sandy rock. The fog has just lifted, and discloses a view of surpassing beauty. On either hand the summits of the hills are crowned with lordly pines, while the sloping land is overgrown with palms and tropical trees. The shore is green with ferns and reeds, whose tufted tassels nod in the gentle breeze. No grass carpets the plain, no flowers embellish the scene, no birds sing in the trees. It is the reign of reptiles. On every hand they swarm—crawling, hopping, stalking by the shore. The water is alive with them—swimming, diving, and filling the air with an indescribable din. All day long enormous lizards crawl through the forests, crushing the reed-like trees before them in their headlong course, or plunge into the sea, leaving a broad wake like a steamer, while others, more fearful still, spread their wings and riot in the air. Sailing in and out among the shallow coves and bays of the coast, the plesiosaur, arching its long neck, eagerly watches a shoal of fish swimming near. But, with quick, sharp strokes of its whale-like paddles, the huge ichthyosaur darts into view, and glares upon its prey with its great bulging eye. Instantly the swan-neck disappears under the water, and the plesiosaur is hidden from its rapacious foe—the terror of the Mesozoic seas. Mighty dinosaurs, rivaling the elephant in size, stalk along the shore or squat on the beach, stupidly gazing on the scene, save when the lælaps, with fearful bounds, leaps among their frightened herds and tears them with his eagle-claws. But night draws on apace. In the dim recesses of the woods, the pterodactyle—that winged dragon so terrible to behold—sails slowly along on its broad leathern wings. As the shadows deepen, mighty sea-serpents

dart to and fro, battling with the rising billows; that huge bloated frog—the labyrynthodon—jumps by with great ungainly hops, while a tiny mammal,* the first of its kind, flies frightened to the shelter of the woods."

[*To be Continued.*]

CORRESPONDENCE.

RECENT FACTS FROM COLORADO.

(*Continued.*)

BY JOHN K. HALLOWELL.

EDITOR REVIEW:

After waiting for the Atchison, Topeka & Santa Fe train, which was two hours late, and came loaded with passengers the most of whom appeared to be determined to board the two small passenger coaches of the Denver & Rio Grande Railroad, we started—every seat filled and the aisles crowded with men standing. The ride to Cañon City must be interesting and novel to those unaccustomed to such scenery; but unfortunately for me, who wished to see everything, by the time we had got into the most interesting part it had become too dark to observe much. Arriving at Cañon City at eight o'clock, p. m., I turned out with the crowd and followed them about a mile, bringing up at the McClure House, which I found jammed full, the men mostly bound for Leadville; a few for Silver Cliff, and as near as I could learn only my solitary self for Rosita. After a good supper, and listening to the talk of the millionaires [prospective] with which the hotel office was crowded, I found, on inquiry for a bed that I was booked to share my couch with a member of the Colorado Legislature. Here was a new experience, but making up my mind that I could stand it if he could, to the room I went. I found Mr. H—— most entertaining, he having come to this country over twenty-five years ago as a U. S. soldier, and for twenty-three years never saw a railroad but knowing every one of any prominence, and I guess they all know him. At all events we found enough to talk about until two o'clock, a. m., and if Colorado is not any better for it, it is not our fault

In the morning we found a slight dash of snow had given everything the appearance of a fleece of wool. Here, at this altitude everything is light; the snow is light, ditto the rain, the atmosphere light, and much of the talk you hear must be set down in the same category, especially if it is about new mining camps, as it takes but little grain to give a large amount of chaff.

"Breakfast at six o'clock a. m. and the coach starts at seven o'clock a. m.,'

* "This was the *Dromatherium sylvestre*, the jaw bone of which was discovered by Emmons in North Carlina. It is the *only* mammal yet known to have existed in America during the Mesozoic Age"

was the information obtained from the urbane gentleman behind the office counter on the evening before. The hour came and so did the coach, seven passengers, six horses and the driver. At the suburbs of the town we met the Leadville coach returning—cause, bridge washed out, so they must stop over twenty-four hours. Just ahead was a party of three on horseback bound for Silver Cliff. They had started the night before, but ten miles up in the mountains, where a bridge ought to have been was a fierce torrent and the bridge gone elsewhere, and before they could turn around the road was washed out behind them, in which predicament they had to camp until daylight showed them the way out of he difficulty, and gave them the opportunity to get back to Cañon City and get a fresh start.

Straight for the nearest mountain we have started and an opening as to where we are to get through does not show. On arriving at the base of the hill a road is found graded up the side of it, and here the old stagers alight, and of course I was not going to ride when the rest walked. Here was the first call I had to test my "wind," and somehow or other before I was a quarter of the way up the ascent, I found my lungs were entirely to small for the quantity of atmosphere required in the exertion; but by stopping and giving them an opportunity to catch up, occasionally, I gained the point of the mountain where the road turns, ten minutes ahead of the coach. Such a grand, magnificent view I never before gazed on. A thousand feet down, at our feet, apparently, nestled Canon City, with the smoke of its hundreds of household fires curling slowly upward in the sunshine of a calm, glorious morning, all surrounded with a fleecy whiteness. Westwardly stretched the valley of the Arkansas with its chains of mountain summits guarding each side of it. Eastward were the broad, wide-spreading plains of Eastern Colorado. North, Pike's Peak with its summit of ice and snow reared aloft, looking so close that it appeared to be only an afternoon's walk away, but on inquiry I learned it was over forty miles from us. South, was hill and peak piled one against the other like the backgrounds to many pictures we have all seen—these were what we had yet to go over; up hill and down, but continually ascending. Thirteen miles out we stopped at the half-way house for dinner. From here the conveyance I was in went on to Silver Cliff, with the other six passengers, and I changed to the Rosita coach which met us at this place. The half-way house comes the nearest in situation and surrounding picturesqueness to the old illustration of the Notch in the White Mountains contained in the school geography I studied when a boy, of anything that my imagination can recall to memory.

Climbing to the driver's seat for companionship, we started, and two miles further on reached another house with a wooden sign over the porch, "Yorkville." Here a mail sack was left and our four horses changed for fresh ones. Six miles further we had gained the highest point of the road, and from that point to Rosita it was heavy wheeling through snow three feet deep most of the time; something that had not bothered us before. At this ridge, or divide, the road up Hard-

scrabble Cañon joins the Cañon City road; distance from Rosita to Pueblo, over the first fifty-one miles, over the latter, from Cañon City, thirty-one; either one well worth riding over to the sight-seer, and many in the summer season give preference to the Hardscrabble Canon route, but from the length of the ride I should think might be rather tedious. However, four o'clock p. m. saw me landed at the hotel in Rosita, with a mind fully alive to take in all of the facts to be picked up by a "tender-foot."

Rosita, a Colorado mining town, is pleasantly situated in a gulch with a southern exposure, overlooking the foot-hills and ranches of the Wet Mountain Valley, and a full, magnificent view of the rugged, sharp-pointed peaks of the Sangre de Cristo Range, whose sides appear now to be covered with snow from foot-hill to summit. The fixed population of Rosita is about 1,000 to 1,200, and the floating population hard to estimate at present, but constantly increasing. Nothing is raised here, so that the grocer is the most important factor in the population. Prices are very reasonable in consequence of the proximity of railroad communication. Hayden, in his report of 1873, speaks of Rosita as a mining camp just started; he visited it and gives the elevation as 8,827 feet. Subsequent elevations taken in the neighborhood of the post office make the elevation 300 or 400 feet less, which difference can easily be accounted for, as a half mile further up the gulch would certainly make that much difference in altitude. Hayden mentions the mines as situated in a formation of "Rhyolitic" granite, while on referring to Reymond's report for 1876 a communication therein states that the mines are situated in a belt of porphyry of from three to five miles in width, and in this belt the most productive lodes have been discovered. As near as I can make out the belt runs in a general east and west course, and is traversed its whole length by dykes of syenite and quartz, the latter carrying the mineral in veins, pockets and chimneys; also many cross-lodes occur, apparently radiating in all directions from the loftiest summits within this belt. This is not yet proven as a fact, nor is it yet proven in which course lie the richest mineral veins, although, personally, I have a belief that those following a general east and west course will eventually prove the most permanent and most productive as to quantity.

The camp was located in 1872 and made a good start, but the panic of 1873 in the eastern cities effected mining enterprises as well as everything else. Following the panic came the San Juan rush, then the Black Hills fever and now the Leadville epidemic is in full blast; but part of the overflow of people has been caught at Silver Cliff, about seven miles west of here, where there are some most excellent mines. In consequence of these other discoveries I do not think Rosita has seen her best days yet by any means. Her time is yet to come; but when she does come to the front she will come to stay. North of the town proper, for about three miles square, the ground at a glance, would appear to have been well prospected, from the number of holes dug; but most of these were worked from two to six years ago. Now, recent developments in mining

for the precious metals show that old ground can be gone over again by prospectors, and what was considered worthless then, may now be of great value. It is in just such parts of the country as this, that the men who put in a few hundred dollars at the time when it is attracting the least attention, eventually reap the greatest returns for their investment. Rosita has these advantages: a situation, in what has been proven to be a rich mineral belt; proximity to supplies and transportation; winters so mild, that generally, out-door work can be done at all seasons; old enough to have a civilization and settled population. What is wanted now, is the attention of and investigation by capitalists, or experts representing them.

There are several miners here working and shipping ore. By the time for another issue I will endeavor to have some facts regarding them, that I trust will be of interest.

ROSITA, COL., April 1, 1879.

SPRING IN THE ROCKY MOUNTAINS.

GOLDEN, COLORADO, April 8, 1879.

EDITOR KANSAS CITY REVIEW OF SCIENCE:

April 3d to 5th I spent in the main central range of the Rocky Mountains west of Gray's Peak, about in latitude 39°, 38′ north, longitude 105°, 53′ west. My altitude (all deduced from spirit level heights) was from 10,130 feet to 11,900 feet above the sea. The main valley runs in an east and west course; the side valley, which leads to an abrupt, sharp divide between the waters of the Atlantic and the Pacific, which is the main crest of the great Rocky Mountain range, called Loveland Pass, is selected as the best location for crossing the Rocky Mountains with a railway line to the promised land of rich carbonates, called Leadville, Carbonateville, and Ten-Mile Valley.

We have had a permanent camp in the main valley since March 25th, just where a fine little glade or open park, fringed with pines and spruce, spreads itself at the northwest foot of a mountain, called the "little Professor," some 13,000 feet altitude

Contrary to all we expected, we find a surprising and agreeable temperature all day long. Scarcely a breeze moves the graceful foliage of the spruces and Canada balsams. The snow lies on the north slopes from three feet to eight feet in depth; on the south slopes and the edge of the park, we find abundant bare ground, while on every side the melted snow trickles under the crust in thousands of rills, and swells daily the small brook that occupies the centre of the valley. When Horace sang:

> "Solvitur acris hiems,
> Grata vice veris et Favonii,"

he could not have described more closely the effect that a southwest wind causes

by its genial influence. The dormant energies of vegetation seem suddenly to act with extraordinary vigor. Our low mountain willows still buried, in many places, two feet deep in soft snow, have formed already their dense white catkins covered with a soft, woolly inflorescence. The alder shoots out its rusty, red flowers, and the mountain birch (*Betula resinosa*) swells its buds and catkins with a vigorous growth, while lower down the valley, at 10,000 feet altitude, the hairy anemone with purple hirsute flowers, peeps out of the mellow sunny banks in tufts of many heads. The *Arbutus uva ursi* (Killikinick), grows green and vigorous, with numberless flower buds.

Ascending the south valley the snow increases in depth up to eight to ten feet on the mountain slope. Where shaded by *Pinus ansteta*, *Abies canadensis* (balsam fir), and white spruce (*Abies alba*), its great bulk is yet but slightly reduced by a brilliant, fervid sun, and a heat at one o'clock P. M., of fully 85°. Ascending to the summit of the range over the just graded track of the Georgetown and Snake river wagon road, I find the twin flower (*Linnæa Borealis*), wherever the ground has been shoveled bare of snow, it is growing thriftily and full of new flower buds, even up to 11,300 feet altitude; while with its fescue-grass (*Favina*,) *Pyrola*, and *Vaccinium*, are everywhere growing rapidly. Every patch of ground is teeming with new life, while flies and butterflies buzz and flit in every direction. Continuing my ascent, after crossing a vast snow-field between 11,400 and 11,900 feet altitude, the summit of the mountain is revealed, bare of snow for a long distance on the south and west slopes; its countless variety of grasses and mossy flowering plants just starting into life. Here the *Silenes*, *Arenarias*, *Saxifrages*, *Gentians*, *Sibbaldias*, *Draba*s, *Crepis*, *Myosotis*, *Eritriclunis*, *Mertensias* and *Ranunculi*, are giving faint indications of the end of that long sleep that begins in October and continues until May. In six weeks time we will find them in vigorous growth, and by June in the glory of florescence, rivaling in brilliancy the rays of that sun whose heat forces them into rapid growth; but of short duration and still more rapid maturity.

The summit of our snowy range in many respects, is akin to Greenland or the Arctic circle; not only in its *flora* but in the animal world that is developed in those lofty isolated summits. We find the birch and willow dwarfed into shrubs, only three or four inches high; while the countless variety of flowering plants are mere diminutive mosses, hardly one inch high, spread in circular patches in sheltered nooks. We find here a lovely *gentian*, three-quarters of an inch high, with fully developed stem, leaves and flower. A real vegetable pigmy.

Accompanying the rapid changes of the whole plant growth, we find in the lower valley a renewal of the activity of animal life. Chipmunks of two varieties; a handsome gray pine-squirrel, and the black squirrel with tufted ears (*Sciurei aberti*), are roaming over the pine trees. The white arctic hare, the tailless marmot field mice, small yellow-foxes, mountain wolves, the wolverene (*Gulo*), mountain sheep, and a handsome pine marten, are not infrequent. Of birds, we

find in the summit of the range: Ptarmigan, (*Lagopus leucurus*) pine grouse, ground sparrows and small, reddish hawk; in the valleys: moose birds, cerulean jays, blue birds and sparrows and an occasional robin, with the ever-present, mischevious magpie, while a little horned owl is first seen three miles below our camp.

Truly, we can say, the rule of old "Father Winter" is broken, the birds, the animals, are fast forming new ties, new homes; all nature teems with renewal; all breathes new life and a continuation of that struggle, which, if not strictly the survival of the fittest, is at least an indication of the renewal of vital force, an effort to maintain the balance between the active and passive forces of creating nature. I am inclined to believe that this, to us, so precocious an exhibition of the effect of returning vigor and growth, cannot alone be ascribed to the power of the sun's direct rays; it must be joined to an evolution of internal heat, stimulating plant growth, apart from the action of the sun which cannot, I am persuaded, act so energetically through three or four feet of snow as to bring out our willows in full inflorescence. E. L. B.

SCIENCE LETTER FROM PARIS.

PARIS, March 16, 1879.

Sixty years ago, Sir Humphrey Davy took two sticks of charcoal and pared them to a pencil point; he connected each of them with a powerful electric battery; soon the sticks became red; placing them wider apart, a luminous jet of light, of a convex form and very dazzling, was generated. This was the Voltaic arc, and the origin of the present system of electrical illumination of large buildings and public squares. Ten years ago a focus of electricity was but a curiosity; it was viewed as a luminous aigrette, flashing from the summit of a building in space like the tail of a comet. To-day this electric light is utilized instead of gas in many theaters, railway termini, markets, public squares, galleries and court-yards. Recently the Prince of Wales visited the printing-office of a leading journal in this city, and was preceded by employés carrying "electric candles." Davy's discovery must be ranked among the most beautiful applications of science. It was in 1817 that Mr. Winsor, an Englishman, experimented with coal gas in Paris; two years later, the city had no less than ten companies—all now amalgamated, and where Englishmen occupy, hereditarily, the chief practical posts.

Returning to Davy's experiment, the electric current passing between the two carbon points effects a veritable change of matter: one of the points wears away incessantly, while the other, enriched by the loss, becomes enlarged. The sticks, slowly burning, engender such an enormous heat that platinum melts in the arc like butter. The brilliancy of the light depends on the interval maintained between the charcoal rods—these must be continually brought nearer to

each other, in order to secure an equal light. To secure this necessary interval a regulator was invented, worked either by the electric current or a clock movement. Another improvement consisted in the use of a superior form of carbon; but the most practical amelioration was the invention of a machine to generate continuously, currents of electricity. This mechanical production of the fluid, without a pile, was based on a singular phenomenon observed by Faraday in 1832. When he brought a piece of soft iron into contact with a magnet around which was wound a coil of copper wire covered with silk, there was an instantaneous current of electricity developed in the wire, flowing, in one sense, at the moment of contact, and, in a contrary, at the moment of removal. This discovery has been ingeniously applied in the Bell telephone. It sufficed then to turn such a coil before a piece of iron in order to obtain electric currents. This is exactly how electric lamps and candles are fed at present, the magneto-electric machine being turned by a little engine. Thus was dispensed with the complicated and costly batteries of bottles, acids and deleterious vapors of the laboratory. In many factories the electric machine is worked by a connection with the ordinary motive power.

For measuring the intensity of light, a carcel lamp in full power, consuming about 1¼ ounces of colza oil in an hour, is taken as unity. Now, the Voltaic arc of Davy, condensed to a point, is too dazzling; it equals, in intensity, several hundreds of carcel jets—it is a morsel of the sun. M. Fitzleau estimates, that, tested by its photographic effects, sun is three-fifths stronger than electric light, and M. Allard calculates that the Voltaic arc is six hundred times more intense than the jet of the carcel lamp. To obtain the intensity of some of these electric arcs of light, it would be necessary to burn, in a vessel, one hundred and seventy pounds of oil in an hour, or consume, during the same period of time, the quantity of gas contained in a balloon having a diameter of thirty feet. Such a quantity of light concentrated on so small a point was inconvenient—it pains the eye. M. Plateau, of Brussels, lost his sight for having too long time observed the effulgency of the electric light during his experiments. The next difficulty to surmount was to distribute the light, to divide this brilliant point or focus, and hang up at various distances on walls, like jets of gas, the luminous morsels as stars. The young Russian engineer, Jablochkoff, has solved the problem. He places two sticks of carbon parallel-wise, soldering them with a special cement; this causes the electricity to flash at both the points of the carbon—the heat instead of consuming the sticks volatilizes the cement, just as the wick does the grease of a common candle. This is the "electric candle." The carbon employed is very pure, so as not to affect the quality of light, and is prepared from graphite and sugar. The electric machine can thus have its currents divided, in being distributed over several candles at once. The light thus produced is very beautiful and admirably fixed. M. Jablochkoff has also invented a "condenser," by which the generated electricity can produce double its illuminating effects along with improved quality of light.

XUM

By pressing a button, the electric candles can be instantly extinguished or lighted; the light, if too strong, can be modified by adding a chemical—strontia, for example—to the cement, or employing dimmed glass lamps or globes. The light which passes through glass thus dulled resembles that from the moon when at its full, only more intense, since the artificial star is nearer to us. The electric is the only light which can be compared with that of the sun, and, consequently, with that of the moon, which is but the reflection of the sun's; it is complete in the sense that it unites the very numerous and very different rays, whose combination produces upon us the impression of white light. The light from ordinary lamps and gas is incomplete; the red, orange and yellow rays abound; there are only a few of green, fewer still of blue and none at all of violet. Hence, why the eye cannot recognize by these lights the true colors of a stuff; the contrary is the case with the electric candle. The electric contains more blue and violet rays than solar light, and this is owing to the volatilization of the carbon and the Voltaic arc, and explains at the same time its wanness, or sickly hue. But these blue and violet rays can be filtrated and transformed into white rays. The electric light radiates no heat nor vitiates the air; hence, purer atmospheres in theaters, etc. It is cheaper than gas by one-third to one-half, and most economical when employed on a large scale—and it is only in this sense that it can be placed in competition with ordinary gas; in every other condition it is simply a luxury.

Dr. Colin again draws attention to the undiminished mortality from typhus fever in the barracks situated in Paris and the large cities. This disease alone carries off yearly three soldiers per thousand, or one thousand two hundred in the standing army of 400,000 men. And this rate continues despite all the severe regulations for securing the comfort and well being of the troops—in the long run, a heavier death-rate than from the cholera. Ordinarily, typhus is most to be dreaded most between eighteen and twenty-four years of age. In the French army the deceases from this malady are most numerous at twenty-two years, and three-fourths of the whole are at the expense of conscripts drawn from rural districts and thinly populated villages. Dr. Colin attributes the cause to the crowding together of so many individuals as fatal to life, as monster hospitals are to the sick.

French surgeons continue to report favorably on the combined employment of morphine and chloroform; sensibility is not only thus blunted while the patient is undergoing an operation, but he retains also possession of his senses and his intelligence, so far as to be able to answer questions addressed to him. The German doctors apply the name *morphiomania*, to a diseased use of morphia; it is a malady peculiar to the educated and the rich, but above all, to those whose occupations necessitate great mental exertions. Injections of morphine under the skin is the favorite plan for immediately relieving intense pain and sleeplessness; for a while it becomes a daily necessity, and ultimately a fatal habit. By means of the Pravaz syringe any person can effect the tiny puncture in the skin, and

inject thus the morphine. The use soon becomes an abuse, for the opiate transforms character; the afflicted become gay; the debilitated re-find their strength; the silent become loquacious, and the timid bold. But once the morphine is eliminated from the economy, profound depression ensues. Relief can be only obtained by stronger doses, and the vicious circle around the unfortunate narrows day by day. The evils are precisely those that follow from alcoholic poisonings. Many recur to the injections to benumb griefs, others to enjoy an agreeable excitement. Strange, indulgence in the passion produces exactly the sufferings, that when first taken the drug was intended to alleviate. The afflicted, when they do not terminate their lives by suicide, perish from *delirium tremens*. Dr. Levinstein, who has treated several cases can suggest no cure; as a preventive, never allow other than a doctor to effect the injection from the first.

Up to the present, nothing satisfactory was known of the manner in which the caseum of milk was transformed into cheese. In other words, chemistry supplied no theory; the observations of Payen remained exact, that the fatty matter of the milk played no part in the change, as its percentage was found to be the same in the cheese. The French Government has deputed M. Duclaux to study the question, and that chemistry finds, that while the fatty matter undergoes no alteration as to proportion, it experiences a kind of saponification and a slight change in taste. In respect to the caseum, it is gradually converted into two albumens; one, soluble in hot water and the other coagulable therein like the white of an egg. In dissolving and replacing the caseum, the albumens impart to the cheese a semi-transparent and soft character, and the quality of melting in the mouth. The changes demand time to be brought about, hence, why cheese requires months to ripen.

M. Corenuinder, of Lille, continues his researches on the chemical composition and the functions of leaves. He has already shown, that during their young age, leaves exhale day and night, carbonic acid; but that this exhalation diminishes as the leaves increase, ceasing completely when mature. A corresponding diminution occurs with respect to the saline and nitrogenous matters. In the case of permanent leaves, the new leaves give off carbonic acid during the day, while the ancient leaves do not possess this property. It is concluded from the predominance of nitrogenous substances in the new leaf, that such serve the functions of respiration, while the rôle of the green matter is limited to the office of assimilation.

Since a dozen of years, in many railway termini, hotels, factories and cities, electric clocks have been employed. These were merely dials, on which the hours and minutes were repeated by means of electric conductors communicating with the type or mother clock. This plan had many drawbacks, owing to the perturbations caused by atmospheric influences. The problem then still remained to be solved, how to distribute in different parts of a city or a building, the exact

hour; how to put in movement a determined number of clocks by means of an apparatus, at once normal and unique. M. Mayerhofer, of Vienna, a machine manufacturer, has met the difficulty. By means of his pneumatique clock, he is able, with compressed air, to lay on the exact hour, as water and gas are distributed by subterranean pipes, and since a year the street clocks of Vienna are thus worked. The hands on the clocks correspond with the meridian of Vienna, of course, and are connected with the central clock by means of tubing and compressed air, which put in motion the minute and the hour wheels. The impulsion comes from the central clock, itself in relation with the observatory. A piston works in a cylinder filled with mercury and pushed by compressed air; a rectilineal movement ensues, corresponding to minutes and hours which is transmitted by the tubing to the several dials. In the central establishment are two reservoirs of compressed air; the first has a pressure of from two to four atmospheres, and the second has one-half atmosphere only. In order that the latter may not vary, the air is freed from its watery vapor by being passed over lime; it is also regulated that it will never exceed the pressure of one-half of an atmosphere. It is, from this second or motive reservoir, that air passes into the tubes; the orifice, or escapement, closes at a fixed number of seconds, and the air rushing along the tubes puts all the clock hands in motion, as it is being sucked back into reservoir number one. There is a tell-tale electric wire, like the service-telegraph in a hotel, that indicates if any clocks be out of order. The invention is accuracy itself and will be seen at work pending the exhibition. It is also so cheap that the fronts of houses are being decorated with fancy clock dials.

Glass type is making way, since Messrs. Montcarmont and Dumas prepare it extensively, following the process of toughening the glass, as discovered by M. de la Bastie. The letters in glass look as sharp and clear as those obtained from the ordinary alloy of lead and antimony; can be cast in the same mold and turn out as well into the bargain. It cannot be "battered," and a blow from a hammer will not injure it. Neither is any change experienced when the forms are heated and then wetted to be suddenly cooled for stereotyping. A pound of glass will yield five times more type than a pound of lead, and in addition, never wears. In chromo-printing, those colors having a base of copper, cannot be employed with ordinary lead type; the latter would decompose the color. No such result ensues with glass type. Also it is cleaner.

F. C.

METEOROLOGY.

REMARKABLE STORM AT NEW ORLEANS.

THEO. V. VAN HEUSEN, SIGNAL CORPS, U. S. A.

On the 16th instant there prevailed at this city and immediate vicinity a severe thunder storm, characterized by some very remarkable features, a brief description of which may be acceptable to those of your readers who take an interest in the meteorological department of your magazine.

During the day in question the atmospheric conditions were such as almost invariably precede thunder storms. The temperature rose to 85°, the humidity was above normal (there being present in the atmosphere during the day from 6.25 to 8.35 grains of vapor to each cubic foot of air), and gentle winds, blowing from the marshes to the southward, prevailed.

At 5 P. M. there was observed in the western sky a cumulo-stratus cloud, whose apex had an altitude of about 30° and the base of which extended along the horizon some 45°. While this base appeared to remain stationary, the convex upper portion of the cloud, which was of a deep brown color with white and curling edges, gradually extended itself until it had overspread two-thirds of the sky. The wind at this time had moderated to a light breeze blowing variably from south to east, and the air was oppressively warm and moist. At 5:30 P. M., before any discharge of electricity had taken place, huge scattering drops of rain commenced falling, striking the pavement with a snapping noise like the cracking of a whip, and spattering to the size of a saucer. A moment later there occurred a vivid flash of zig-zag lightning, instantly followed by a crashing peal of thunder and rain descending in torrents. This continued until 5:55 P. M., when a shower of hail commenced falling, which, for size and quantity of the hailstones, is said to have exceeded any phenomenon of the kind heretofore experienced in this section of the country. During a period of five minutes or more the ground was white with hailstones, which, upon measurement, were found to be from one to five inches in circumference. At 6:20 P. M., or after a continuance for the remarkably long period of twenty-five minutes, the hail ceased and rain, descending in sheets, followed until 7:50 P. M. From 6:40 P. M. to 6:45 P. M., there was a second shower of small hail mingled with the rain.

The electrical display during the storm was of unusual magnificence. The lightning flashes were intensely brilliant, being almost exclusively of the zig-zag order—showing the conducting power of the different portions of the atmosphere to be very unequal—and followed each other in rapid succession, while the peals of thunder were long, loud and incessant.

The rainfall was very heavy, 2.82 inches being collected during the two hours and twenty minutes that the storm prevailed. Throughout the lower part of the city the streets were transformed into canals, the water in many sections being waist deep and flooding the lower stories of dwellings. All street travel was necessarily suspended.

The largest hailstones appear to have fallen in the western portion of the city, that being the section first traversed by the storm. Gentlemen whose statements cannot be accepted as otherwise than perfectly reliable, affirm that in that quarter of the city the hailstones were as large hens' eggs in their greatest circumference. Assertions are made that hailstones of this size were picked up after fragments of them had been broken off by violent contact with the pavement. A prominent gentleman who picked up and measured two large hailstones, gives their dimensions as follows: One, 2½ inches long, 2¼ inches wide, and 1½ inches thick; the other, 2½ inches long, 2½ inches wide, and 1¼ inches thick.

The damage occasioned throughout the city was considerable. Sky-lights and window-glass were broken, conservatories, nurseries and hot-houses suffering severely in this respect, with the addition of the total destruction of many valuable plants. Many of the slates which form the roof covering of the majority of houses in this city were cracked and splintered, while some of the extra heavy plate-glass (¼ inch in thickness) in the sky-lights of the U. S. Custom House were cracked. Trees were denuded of their foliage, shrubbery beaten to the ground, and one instance of serious bodily injury is recorded from the falling hailstones.

During the prevalence of the storm a game bird, of a species known as "blue rail," and which is rarely seen in this section, though sometimes encountered in the marshes 100 miles south of the city, fell to the pavement dead. Upon examination its back and wings were found to be covered with ice, showing it to have passed through a current of air whose temperature must have been considerably below 32°.

The fall of temperature during the progress of the hail storm is somewhat remarkable. At 6 P. M. the thermometer read 80°. At 6:25 P. M. it stood at 65°, a fall of 15° in twenty-five minutes.

But little wind accompanied the storm, the highest recorded velocity being twelve miles per hour. Violent gusts at street corners and exposed places, sufficient to destroy umbrellas, tear down signs, awnings, etc., were reported. The wind, which previous to the storm had been blowing gently from the southeast, after its passage blew briskly from the north.

Advices from various portions of this State show similar, though much less violent and remarkable disturbances to have taken place.

NEW ORLEANS, LA., April 21, 1879.

STATISTICS OF METEOROLOGY IN THE CITY OF OAKLAND, CALIFORNIA, FOR THE YEAR 1878.

Observations taken at seven o'clock A. M., two o'clock P. M. and nine o'clock P. M. of each day, by J. B. Trembley M. D. Latitude, 37 deg. 48 min. 20 sec. north; Longitude, 122 deg. 15 min. 20 sec. west. Height above the sea twenty-four feet.

TEMPERATURE.

Table showing the mean temperatures of the months, warmest and coldest days; also, the maximum and minimum temperatures, the greatest and least daily variation, monthly and mean daily range of 1878.

1878	Mean Temperature of the Months.	Mean Temperature of Warmest Days.	Mean Temperature of Coldest Days.	Maximum Temperature.	Minimum Temperature.	Greatest Daily Variation.	Least Daily Variation.	Monthly Range of Temperature.	Mean Daily Range of Temperature.
January	50.03	57.66	36.66	66	28	20	3	38	10.66
February	50.81	56.66	45.00	61	38	19	2	23	10.14
March	54 02	60.33	47.00	69	39	20	4	30	11.03
April	55.30	62.00	45.33	73	40	21	6	33	12.63
May	57.88	65.00	55.00	81	47	24	7	34	13.67
June	59.34	64.33	56.33	79	52	24	9	27	13.06
July	59.20	64 33	56.33	79	52	24	9	27	13.06
August	59.55	65.00	57.00	77	53	22	6	24	12.25
September	59.32	64 66	56.00	79	48	23	5	33	13.93
October	58.05	69.33	51.66	84	42	33	7	42	19.70
November	53.39	58.00	47.00	69	36	27	3	33	15.13
December	46.49	58.00	37.00	73	27	33	4	46	18.61
Means	55.28	62.13	49.19	74	41	24	5	32.5	13.65

RECAPITULATION OF TEMPERATURE.

Mean temperature of the year	55.28
Mean temperature of warmest day, October 21st	69.33
Mean temperature of coldest day, December 29th	37.
Maximum temperature for the year, October 21st, two o'clock P. M	84.
Minimum temperature for the year, December 29th, seven o'clock A. M	27.
Greatest daily variation, December 3d	33.
Least daily variation, February 17th	2.
Greatest monthly range, December	46.
Least monthly range, February	23.
Average daily range for the year	13.65
Average monthly range for the year	32.5
Yearly range of temperature	57.

SEASONS.

Mean temperature of Spring	55.73
Mean temperature of Summer	59.36
Mean temperature of Autumn	56.92
Mean temperature of Winter	50.12
Difference between coldest and warmest months of Spring	3.86
Difference between coldest and warmest months of Summer	.35
Difference between coldest and warmest months of Autumn	5.93
Difference between coldest and warmest months of Winter	1.28
Difference between coldest and warmest months of the year	13.06

XUM

METEOROLOGICAL SUMMARY FOR MARCH, 1879.

SIGNAL OFFICE, LEAVENWORTH KANSAS, APRIL, 1, 1879.

The most notable features of the meteoric conditions, during March, were the generally high pressure; high temperature; low humidity; light rainfall and no storms.

The mean barometer of the month was 30.053 inches, about .06 above the March mean. During the first three days of the month the pressure was notably high. The mean of last month was higher than that of any year since 1872. The highest barometer during the month was 30.603 on the 2d. The lowest, 29.573, on the 8th.

The mean temperature of the month was 45.42°, about 6° above the March average, and with the exception of 1872 (50.90°), the highest March mean ever observed at this station. The highest temperature during the month was 84°, on the 27th, which was the highest temperature ever observed at this station in March. It was ten degrees above the mean of March maximum temperatures. The highest March temperature previously observed, was 80°, in 1878. The lowest temperature was 9° on the 14th. Greatest daily range 40°, on the 23d and 27th. Least daily range 8°, on the 16th.

The mean percentage of humidity during the month was 55.52, being 11.54% below the March mean. The lowest observed during the month was 11% at 2 o'clock p. m., on the 23d. The mean of last month was less than any March since the station was established, in 1871.

The total rainfall during the month was 0.32 inches, which was 2.79 inches below the March mean. The lowest March rainfall previously observed at this station was 1.75 inches in 1873. The greater portion of the precipitation last month fell during the first five days of the month.

The prevailing wind of the month was north. Highest velocity thirty-six miles, from the N. W. at 3:40 p. m., 23d. Total number of miles registered during the month, 6997. The wind's direction was recorded 217 times as follows: N., 56 times; N. W., 42 times; W., 2 times; S. W., 10 times; S., 47 times; S. E., 16 times; E., 14 times; N. E, 18 times and calm 12 times.

Number of clear days during the month 9; fair days 14; cloudy days 8 and number of days on which rain or snow fell, 6. A solar halo was observed on the 23d; a lunar halo on the 31st and polar bands on the 17.

The following table showing mean barometer, thermometer and humidity, total rainfall, maximum and minimum temperatures and highest and lowest barometer, during March, of the past seven years, is furnished as an item for comparison:

YEAR.	Mean Barometer.	Mean Thermometer	Mean Humidity.	Total Rainfall.	Maximum Temperature.	Minimum Temperature.	Highest Barometer.	Lowest Barometer.
. . . . .	. . .	deg's.	per c't.	inches.	deg's.	deg's.	. . .	. . .
1872	30.093	37 08	67.35	1.95	70	16	30.760	29.250
1873	30.015	42.10	. . .	1.75	73	5	30.670	29.470
1874	30.010	40.00	70.40	3.05	69	18	30.656	29.290
1875	29.967	37.60	60.20	2.50	78	9	30.427	29.354
1876	29.986	35.16	72.60	5.78	68	2	30.605	29.421
1877	30.003	38.40	69.80	4.39	78	7	30.453	29.388
1878	29.856	50.90	62.00	2.35	80	28	30.257	29.339
1879	30.053	46.42	55.52	0.32	84	9	30.603	29.573
Average of Years.	29.990	40.18	67.06	3.11	73.7	12.1	30.547	29.359

SAMUEL W. RHODE,
Signal Corps, U. S. A.

MINING AND OTHER INDUSTRIES.

DESCRIPTION OF VARIOUS MINES IN COLORADO.

BY JOHN K. HALLOWELL.

As Messrs. Hayden and Raymond, in their reports have not given us a nomenclature of the rocks and minerals of this locality, I have thought best to merely use the names for the different rocks as known locally, although satisfied that scientifically they are not, as a general thing correct.

From the divide near the head of Hardscrabble Canon and following a south of west course, is quite a valley with a general gentle inclination down to the foot-hills bordering the Wet Mountain Valley. On the south side of this and among these foot hills, Round Mountain and Silver Cliff are situated, and about six miles west of the Franklin and Maine Mines, the elevations on the south side with their foot-hills are Porphyry; those elevations to the north, Granite; the deepest denudation of the valley following the line of contact, with spurs of Trachyte appearing between the granite hills to the northward.

The Porphyry formation is easily distinguished by the largest axis of the hills following the general course of the valley, viz: East and west. Their rounded tops on the south side bare of trees, covered instead with grass and verdure, no massive out-crops of rock like the granite hills, and having the steepest slope on

the south side, the gradual slope on the north, and generally on this side heavily timbered to their summits with aspen, pine and spruce, the aspens taking up their location among the gulches and foot-hills where, of course, the most moisture and vegetable mold accumulate.

The highest one of these porphyry peaks is Mount Tyndall, and on its north foot-hill is situated the justly celebrated *Maine (or Bassick) Mine.* Not having obtained the desired data regarding this wonderful mine, (but which I hope to have with reports of others for your June issue) I merely mention it at present to record the following extract, in connection with an illustrative fact:

"The intervention of intense heat, sublimation, and similar hypotheses to explain the origin of metallic ores, we conceive to be uncalled for. The solvent powers of the solutions of alkaline carbonates, chlorides and sulphurets at elevated temperatures, taken in connection with the notions above enunciated, and with De Senarmont's and Daubrée's beautiful experiments on the crystallization of certain mineral species in the moist way, will suffice to form the basis of a satisfactory theory of metallic deposits.—*Chemical and Geological Essays, by T. Sterry Hunt, page 221.*

At a depth of 160 feet in the Maine Mine, and attached to the small boulders or pebbles that this ore deposit contains, have been found pieces of *charcoal.* Mr. Hunt could not have a better illustration of his theory if he had fixed up this ore deposit himself.

Next, in present importance and value, of the numerous mines in this section, is the "*Benjamin Franklin Mine,*" which was purchased by the present owners in the fall of 1877. At the time only a discovery shaft had been sunk but which gave good indications of a permanent deposit of mineral—in fact, a pocket in the quartz had been opened, consisting, mainly, of carbonates and a few tons of mineral obtained, which gave good mill returns. On the present management obtaining control, a new exploration shaft was started and sunk to a depth of seventy feet. At this point drifts were run in different directions, one of forty feet north; one of forty feet south; one of twelve feet west and another of seven feet east and no mineral found. But being satisfied that it was there and in paying amounts, work on the surface was commenced again near and just above the original discovery shaft. Here, at a depth of about ten feet a small pocket of of carbonates was found, and from that point mineral has continued in pockets of quarter or less amounts to a depth of 200 feet. The pockets produced each from a few hundred pounds to sixteen tons. From the seventy foot exploration shaft one of the drifts was continued westward to this, what is now the main shaft. The old discovery shaft was sunk down to it also, and is now used as a manway, the drift or tunnel being used for ventilation, so that what at first appeared as a loss in the working, has, by good management and judgment been made of great advantage and practical utility in the working of the main shaft, which the tunnel opens into at a depth of 105 feet. The strike of the lode is in an east and west course, the dip south one foot in three. The quartz is used as a foot-wall,

and partially removed as the shaft is sunk, the hanging wall being Porphyry, and compared to the quartz is very easily worked. Down to water level the mineral was principally carbonates, with occasionally a mass of galena of fifty or sixty pounds. At about ninety feet water was reached, and the mineral was found in the pockets in a crystallized form. It is principally Argentiferous galena, with zinc blende, iron and copper pyrites; some gray copper and also antimonial silver. The first indication of approach to a deposit of mineral, is the shattered condition of the quartz and an increased flow of water. On top of the pocket, when first opened, is found metallic geodes, weighing from a few ounces to several pounds. On breaking one open the center will be of pyrites, surrounded with a ring of zinc blende or galena, also spots of gray copper intermingled and a thin band of antimonial silver surrounding the whole between the galena and zinc. Passing below the layer of geodes the mineral is found finely crystallized and easily worked, the bottom of the pocket producing the largest mill returns generally. Usually a thin streak of mineral leads from one pocket to another. At a depth of about 170 feet, a five ton pocket was emptied, and a horizontal streak of mineral was seen on the north side, which, on being followed up led to a larger pocket on about the same level. This would indicate a probability of a very much larger amount of mineral being still in the quartz above than has been taken out. From the latter deposit some very fine geodes were obtained with a center of *quartz*, both massive and crystallized, and surrounded with the other metals same as those containing a center of pyrites, and out of this a picked specimen of brittle (antimonial) silver gave an assay of 1876½ ounces per ton, although the mill result was not as high by a few ounces per ton as the previous pocket. On breaking through the north wall of this chamber a soft gangue was found, and beyond that the Porphyry, showing that the quartz had been entirely penetrated at this point and giving thickness of about fourteen feet.

The motive power being mules, a whim and two buckets, it was determined to run levels at a depth of 200 feet, and accordingly that work is being done. Simultaneously, levels in an east and west direction were started. The east one has been run but twenty-five feet and, appearing barren, has been temporarily stopped. At seven feet from the shaft on the west drift a large pocket was cut through and mineral left both above and below; that above being stoped out by one man, and the level continued by the rest of the force west, for a distance of forty-five feet. Here the quartz was found much shattered, and containing considerable heavy spar, which is a most excellent indication. But it was found that the quartz here narrowed down to about four feet, and a return level is now being run on the north side of the lode, which will probably develop more mineral on that wall, and when continued so as to open into some of the last pockets emptied in the shaft, will form a most excellent air-conductor and ventilator for new work still farther west.

Among the minerals, I have seen some fine crystals of Franklinite attached to the quartz, and in the decomposed rock near the pockets I have obtained per-

fect crystals of that mineral, free and also fine crystals of pyrites, and, what is quite uncommon in this camp, these pyrites will give good assays in silver.

On the surface, about 300 feet south and parallel with the quartz outcrop of the Franklin, is a large dyke of syenite toward which this quartz lode dips, and towards the bottom of the shaft, jutting through the Porphyry, (properly speaking *Trachyte*) blocks of this syenite have been met, indicating that somewhere, not a great distance farther downward, there is a place of contact between the two dykes of syenite and quartz. At this place of contact will probably be found a regular vein of richer mineral pitching downwards in addition to what the quartz may contain in pockets.

The present condition and past results obtained in this mine reflect great credit on the working management, and give all who are acquainted with it confidence that the future workings will not only give much pay mineral produced by careful and economical supervision, but also prove a source of large profit to all of the owners. Two shifts of men are employed, twelve in all, with two boys to operate the mules, constant work being kept up, except from mid-night of Saturday until Monday morning, and during this idle time only forty to fifty barrels of water accumulate in the shaft.

While the products were carbonates or free milling ore, it was treated at the Pennsylvania Company's Reduction Works, at Rosita. Afterward, becoming too refractory for their process it was shipped by wagons to Messrs. Mather & Geist, Pueblo, Colorado. The road from here to Pueblo is down hill most all of the distance, (fifty miles) through Hardscrabble Canon. Freight is $8.00 to $10.00 per ton, according to season and condition of roads. During the last two months over twenty tons of mineral have been shipped, (leaving about three tons on hand at this date) and giving mill returns of 121 ounces to 174 ounces in silver, or an average of about 142 ounces. No expense is incurred for sorting this ore, as when a pocket is opened it all comes in a body, and is merely dried by the ore-house stove and sacked ready for shipment, each sack averaging about 140 pounds. As an instance of how free this mineral is to mine, in the pocket mentioned as being on the north wall, the second day after it was opened, one man in one shift of eight and one-half hours took out over two tons of pay mineral.

I have endeavored to be thus minute in the description of this mine, as well as exact, from the fact that it is for this camp a remarkable ore-body, and also that it is a successful development where many others would have failed in producing pay. I am under obligation to Mr. Thurman, General Manager, and Mr. Williams, Foreman, for the facts and facilities for observation, the results of which I have given.

SAN JUAN MINING ITEMS.

THE DIAMOND TUNNEL.—The editor of the *Miner* visited this tunnel yesterday, and we can report most favorable progress since our last visit one week ago. A very rich streak of mineral was struck the day following our visit last week, and this streak has continued to improve and is undoubtedly a permanent pay streak. The ore is as fine looking as any we have seen in the country. Assays of the streak made during the week by E. T. Sweet gave 395 ounces in silver to the ton. The drift west from the tunnel has been pushed fourteen feet during the past week through a good ore body the entire distance. A stope will soon be started. The main tunnel is progressing finely and a drift will be started on the vein just passed by the face of the main tunnel. This vein we regard as one of the most promising on the mountain. It is over five feet in width and has a large body of ore. It appears far superior to the vein upon which the drifting is now being done, looked at from the point where the tunnel intersected it. We are most thoroughly convinced that there is no more valuable tunnel property in San Juan than the Diamond tunnel of the Silver Producing Mining Company. All parties familiar with the mountain believe that good paying veins will be tapped by the tunnel every 100 feet for the next 1,000 feet. Work will be pushed upon this enterprise with all the force that can be worked to advantage, and we are satisfied that its ore product for the summer will be a most agreeable surprise to its owners, for in less than six weeks it will be sending out ore from at least four good paying lodes, any one of which will be opened to a depth of 250 feet.

MOUNT SNEFFELS.—Mr. John Wilson and R. B. Brown came over from Mt. Sneffels yesterday. Mr. Wilson has been at work on the Yankee Boy since last fall. They have been running a cross-cut tunnel during the winter. They have run over 200 feet and have tapped the vein at a depth of 100 feet. The vein, where it has been tapped, looks well.

The Eldorado, owned by Shultz & Rinkor, has also been worked during the winter. The owners have run a tunnel on the vein, which is looking splendidly.

The Virginius has been worked all winter by fourteen men. They have about 100 tons of first-class ore out.

The Blackbird, on Bear Creek, is turning out splendidly.

The Crusader, owned by Weston & Co., has just been started up. This mine shows a good vein of mineral.

The company that owns the Wheel of Fortune, will commence work in a week or ten days. This mine will be worked extensively this summer.

The company which purchased the Quinn and Gichardson mines will also commence work early in the season.

Mr. Wilson says the trail is in first rate condition. They made the trip from Sneffels yesterday without use of snow shoes.

HOWARD FORK.—A very rich gold lode, in a most peculiar formation, has been discovered on Marshall Creek, one of the tributaries of the San Miguel.

The lode is called the N. W. H. Jr., and is owned by Andrews & Savage. There is a crevice eight feet wide, with twenty-seven inches of Galena ore. There is a tunnel on the vein fifty feet in length. In running this tunnel the owners have crossed a streak of gold, imbedded in the galena. The streak was half an inch in thickness, and Mr Scott, who gives us the item, says that the owners have taken out a cigar box full of almost pure gold. This mine is located about six miles from Ophir.

THE SMUGGLER LODE.—This lode is also located on Marshall Creek, and is owned by Osburn & Ingraham. This mine has a four foot crevice and a pay streak of twelve inches of galena and gray copper. They have $12,000 worth of ore on the dump.

There have been three pack train loads of ore shipped from the Nevada lode to Ouray this spring.

THE EUREKA MINING CO.—The Eureka Mining Company of Wyandotte, Kansas, owns three good mines near Eureka, in this county. The property is very desirably located for working, being only half a mile from the Reduction Works of Winspear & Co., at Eureka. The property was located by Mr. Peters some four years ago, and is among the best in that rich camp. The names of the lodes are the Daisy, Little Maud and Paymaster. The Daisy carries some very rich mineral, assays made by Cady & Olmstead, of Kansas City, giving 884 ounces of silver to the ton of ore. The company also owns a valuable mill site and water power, only one-fourth of a mile from Eureka. Dr. W. C. Hamilton, of Topeka, Kansas, is secretary of the company, and Fred C. White and N. McAlpine, of Kansas City, are large stockholders, and we understand the company will commence work in a few weeks upon their property and will push its development this summer. They have splendid property, and we are satisfied they will meet with success.—*La Plata Miner.*

THE ALASKA CONSOLIDATED.—Within the last sixty days a most important mining transaction, to the San Juan country, has been closed. At the head of Poughkeepsie gulch, which is partly in the San Juan and partly in Ouray county, are a number of mines which have attracted marked attention from the richness of the ore produced and the ease of working. The discoverers were not able to expend the capital necessary to develop them, and last season some eastern parties, principally residents of Cleveland, Ohio, secured a bond on the property, organized the Alaska Consolidated Mining company, and quietly awaited developments. Previously however, four practical miners, Messrs. Bennie, Renfro, McElroy and McCormick, secured a lease on a royalty from November, 1878, to June, 1879. They went to work in November, with a slender capital, but in eight days had taken out enough ore to buy a stock of tools, provisions, powder and steel to last them through the winter. At the last report their ore on the dump, three-quarters of product, was worth $15,000, and will probably, by June 1st, net them $20,000. This was done on the Adelphia alone; the other lodes

are the Alaska, Acapulco and Victory, and all were included in the property acquired by the company, which was organized on a basis of a capital stock of $2,000,000, in shares of $25 each. Attracted by the reports of the richness of the San Juan veins, Messrs. Tabor and Rische investigated the country, and purchased in the Red Roger and Saxon. Afterward they tried to buy out the mines above named, but could only get a one half interest, which they now hold.

The new company will work their mines, using all the force that can be operated advantageously and for the present will sell their ore. Their property is most advantageously located in respect to reduction works, it being four miles to the San Juan reducing works at Gladstone: three miles to Animas Forks concentrating works; ten miles to Ouray, where there are three smelters; eleven to Silverton and twenty-two to Lake City. In the Adelphia is a vein of gray copper, with spar and pyrites, of five feet of mineral which averages five hundred ounces, it runs all the way from ninety ounces to eleven hundred. The property is a veritable bonanza and is held for profit and not for sale. The purchase is a significant fact, showing that the true fissure veins of the San Juan country are regarded as good investments, even by men who made their fortunes in carbonate fields. It proves that all the capital and all the enterprise will not locate in one place or in one spot, but that the wonderful resources of Southwestern Colorado are beginning to receive due recognitition and suitable acknowledgement.

—Denver Democrat.

THE COMMERCIAL APPLICATIONS OF REFRIGERATION.

The comparatively new business of exporting live cattle from this country to Great Britain has had very remarkable vicissitudes—at times returning good profits, and at others entailing heavy losses. Several hundred head per week are being shipped from our port, but it may be rather premature to judge what will be the final result in this department of the business if the existing restrictions are long maintained. It looks, however, as if there might be a renewal on a much larger scale of the former only partially successful effort of shipping dressed beef. This branch of the business has of late excited a great deal of attention so far as Boston is concerned, and quite extensive preparations are under way for its development. One of our Liverpool lines has already several steamers fitted with refrigerator accommodations on a liberal scale, and similar arrangements are being introduced into another line. In fact, one steamer was delayed here a day the present week, so as to be supplied with a refrigerator room. One of the very largest cattle dealers of this country is in town, partly to make arrangements as to sending dressed beef of his own to Liverpool, and he has forwarded several heavy shipments lately from this port. Last year, a number of the shipments of beef arrived on the other side in poor and unprofitable order, owing to long voyages or inadequate refrigerator arrangements, or both. The refrigerators already in-

troduced and in use upon some of our Liverpool steamers represent several different makes, the object in this seeming to be to test the comparative merits of each. There is a very sharp competition between the representatives here of the some half a dozen leading makes of refrigerators used in transportation, each naturally claiming that his own is, upon the whole, the best system, and seeking for it some advantage.

The ocean voyage, even from this port, is so much longer than the inland journey, and so much more risk is involved on shipboard as to delays and other causes, that extra caution is required of shippers, and the best possible refrigerator arrangements demanded. Up to this time, ice has been the only agent used on cars and steamers to secure a preservative temperature. Chemical methods, however, have been under private experiment by different parties the world over. There are also at least two different parties in this city now engaged in experimenting on a large scale with systems of producing cold, without ice and without chemicals, by—as it were—pumping the caloric out of the refrigorating chamber. The parties referred to as engaged in these experiments have made substantial progress in the use of their machinery, but the matter has not yet sufficently matured for public exhibition. The purpose in the new system is to run the machinery by power to be obtained from the steamship's boilers.

Until the new plan is open for thorough public examination as to its workings, it would be premature to announce anything more than that those engaged in the matter are sanguine, from what they have already accomplished, that they will secure a practical success. Should the anticipations of those working on the new system be realized, quite a revolution would take place in the method of refrigerator transfer, both on rail and ocean, as well as in cold warehouse storage on a large scale.—*Boston Journal of Commerce.*

NEW INSTRUMENT TO DETERMINE THE PRESENCE OF METALS IN ORES.

At a recent meeting of the Philadelphia Academy of Natural Sciences, Prof. George A. Koenig, of the University of Pennsylvania, exhibited his recently invented "chromometer," an instrument designed for the purpose of making exquisitely delicate determinations of the presence of certain metals in ores. It is based upon the optical fact that complementary colors will extinguish each other if mingled in proper proportions; for instance, if to a green solution a red solution be added, the liquid, if the proper conditions be complied with, will become colorless. The speaker had applied this principle to the colors which certain metals, as iron, manganese, copper, etc., produce when fused with borax, which is the only chemical used in this method of analysis. He prepares such glasses or beads containing known quantities of a metal in one hundred parts, and observes how thick a glass of the complementary color must be to produce

extinction. To accomplish this, the instrument is furnished with a glass wedge of a green or red color, cut at an angle of about one degree. By moving this wedge before the glass bead, with the help of a suitable rack movement, a scale moves at the same time, and, when the point of extinction of color is arrived at, the reading of the scale refers to a table showing the percentage of metal contained in the examined substance. By this method of analysis a correct determination of manganese in an iron ore can be made in fifteen minutes, which is not more than one-third the time required by the usual methods of analysis.—*Scientific American.*

HOW TO GET TO SAN JUAN.

Parties who desire to get to Animas Forks, Mineral City, and all important points in the San Juan country, can now do so without difficulty, by coming by way of Cunningham Gulch. The wagon road is now open to the foot of Grassy Hill, on the other side of the range, and from Highland Mary, on this side. Pack-trains have already been sent through to Animas Forks, from Silverton, loaded with supplies.

The development of the mines of San Juan has fully demonstrated the fact that Silverton is the gateway to the treasury vaults of the San Juan country. It is the most beautiful location for a town in all southern Colorado, added to the fact that in every direction from it are mines which have been found rich and paying properties. The development of the country is far in advance of the city, and those who invest their money in business enterprises in the city have the assurance that the mineral wealth of the immediate vicinity is a guarantee of profit in any business undertaking. It is only twenty miles from Silverton to the head of the Dolores, and animals have already gone over, via Howard Fork. The Needle Mountain district is south of us, only twenty miles. Howard Fork, Turkey and Bear creeks west, twelve to fifteen miles; head of Cement and Poughkeepsie Basin, nine to ten miles; Kendall mountain, half a mile; Hazleton mountain, two miles; Arastra Gulch, two and a half miles, Sultan mountain, one mile; Cunningham Gulch and Howardsville, four and a half miles; Eureka, eight miles; Burns' Gulch, ten miles; Picayune Gulch, ten and a half miles; Animas Forks, twelve miles; Mineral City, fourteen miles; Mount Sneffels, eighteen miles. So it will be seen that Silverton is the center. The above named points, all noted for their rich mines, are in every direction from our town, and all, excepting only Mt. Sneffels, must become tributary to Silverton, as the great business center of San Juan in the future.—*La Plata Miner.*

SCIENTIFIC MISCELLANY.

TESTS OF SILKS.

A lady who has visited the most important silk factories in Europe has given the result of her observations in this connection. She says it is next to impossible to detect the genuine article, and that she knows of but four reliable firms who tell the truth about their products. She gives the following suggestions: "If the sum at disposal be moderate, a very good silk is forthcoming, though it may not be a cord; if a useless dress is wanted, the silk ordered, for instance, is a robe *de fatigue*, or it is a *drap d' Anvers*, or a *drap de Rhone*, the word "drap" at Lyons not signifying cloth, but plain, close textures of black silk. Samples should be written for, and when in hand there is a method for selecting a good silk from a bad one. If, after having made a fold on the cross in a sample received, it is not easily effaced by pulling it over again with the first finger, or by pulling the material in a contrary direction, that silk is bad. If, on the other hand, the ridge imperceptibly disappears, the material is good, for silks should be supple, however thick."

Another writer on this subject adds some additional hints of a noteworthy character:

"Formerly, the silk manufacturers used ungummed silk both for warp and weft. The ungumming softens the silk and removes from it a resinous matter; but there is a great loss of weight—in French silks 25 per cent, but in Chinese silks sometimes 40 per cent. The manufacturers have, for some time past, ungummed merely the silk for the warp, leaving that for the weft raw, as the threads of the warp are not seen.

"In this manner a great loss of weight is avoided; but the goods, as soon as wetted, become uneven. This happens especially where such tissues are dyed, when the weft is attracted by the color and the mordant, and becomes rough and broken. Like all other fibers, that of silk consists of a number of small particles linked together. These become prominent on ungumming, so that when a silk fabric consisting entirely of ungummed silk is moistened, no alteration appears. But in common silk goods this only happens with the warp. The moistening, finishing, etc., of these goods occasion a difference between the threads of the warp and weft. This explains the distortion of such goods, and their tendency to break in the folds,"

Concerning the color of black, there are very unreliable green-blacks and dun-blacks. The real blue-black is the highest esteemed. The raven's-wing has a blue haze over it. It is said that no one not in the business can know how difficult it is to get a glossy blue-black in the matter of silk goods; a dead black is

not the accomplishment of this end. Cheap qualities of silk would not reward the manufacturer for his trouble; hence a brown or green-black are of inferior fiber. Experts in the selection of silks adhere to certain rules which guide them in the matter. Among others is that of noting the closeness and evenness of the rib in the fabric, and to facilitate this end they hold it to the light, by which means the character of the texture is discovered. The goods is crushed in the hands also, and if it springs out quickly when suddenly released, what is termed verve is developed. The quality of the silk is denoted by the verve. The softest silk produced is said to be the Italian, possessing little stiffness in its appearance. The Chinese silk is the most inferior and deficient in verve. And there is a kind of silk produced, in the manufacture of which jute is used in the process of adulteration, which is interwoven in the fiber of the silk. This fabric is found very deficient in verve. It is a silk which, if wetted, stiffens similar to paper.

Iron can be protected from rust and made very pleasing in color by a method invented by Mr. Dode. He coats the surface with a thin film of borate of lead, in which some oxide of copper has been dissolved, and some scales of precipitated platinum held in suspension, by means of a brush or a bath. He then heats the composition until it is fused. The result is a thin, glassy coating, which will withstand the action of sewer gases, dilute acids of alkalies, and the heat of a kitchen fire. If all be true that is said of this "platinized iron," as it is called, it will find numerous applications.

MAKING LUMBER FROM STRAW.

Mr. H. S. Hamilton, of Bushnell, Ill., has discovered a process for making hard-wood lumber out of common wheat straw, with all the effects of polish and finish which is obtainable on the hardest of black walnut and mahogany, at as little cost as clear pine lumber can be manufactured for. The process of manufacture, as explained by Mr. Hamilton, is as follows: Ordinary straw board, such as is manufactured at any paper mill, is used for the purpose. As many sheets are taken as are required to make the thickness of lumber desired. These sheets are passed through a chemical solution, which thoroughly softens up the fiber and completely saturates it. The whole is then passed through a succession of rollers, dried and hardened during the passage, as well as polished, and comes out of the other end of the machine hard, dry lumber, ready for use. It is claimed that the chemical properties, hardening in the fiber, entirely prevent water soaking, and render the lumber combustible only in a very hot fire. The hardened finish on the outside also makes it impervious to water. The samples exhibited could hardly be told from hard-wood lumber, and in sawing it the

difference could not be detected. It is susceptible of a very high polish, and samples of imitation of marble, mahogany, etc., were shown which might deceive the most experienced eye. Not only does Mr. Hamilton claim a substitute for lumber in sash, doors and blinds, and finishing stuff, but also as a substitute for black walnut and other woods in the manufacture of all kinds of fine furniture, coffins, etc., and also an excellent substitute for marble in marble-top tables, mantelpieces, bureaus, etc. He claims that it will not warp in the least.—*Leffel's Mechanical News.*

BOOK NOTICES.

PRACTICAL INSTRUCTION IN ANIMAL MAGNETISM. By J. P. F. Deleuze. Translated by Thos. C. Hartshorn. New York: S. R. Wells & Co. Pp 524, 12mo.

M. Deleuze was first known to the scientific world by his translation of Darwin's "Loves of the Plants," which he published in 1799, and which gave him an established reputation among scholars and naturalists. Subsequently he published a comprehensive work named "Edoxus," which was a general summary of existing science, in the form of conversations upon the study of the sciences, letters and philosophy. His devotion to botany and kindred sciences did not prevent his giving attention to other things, and he was distinguished as a naturalist. At the same time he devoted himself to the study of Animal Magnetism, which about the close of the eighteenth century was creating great excitement on the continent. After reflecting on and investigating the subject for a quarter of a century, he published the work now under consideration, which, even at this late day, seems to cover all that is known of either the history of magnetism or the science itself, including, as it does, its general principles, its effects and their application, the accessory means for increasing magnetic action, its application to various diseases, etc., etc. The work of translation seems to have been faithfully and carefully done, and the publishers have done their part handsomely and tastefully.

THE NATURAL RESOURCES OF THE UNITED STATES. By J. Harris Patton. New York, 1879: D. Appleton & Co. For sale by M. H. Dickinson, Kansas City; 50c.

The numerous series of Science primers, History primers, Health primers, Literature primers, now being published by the first publishing firms of the country, and the great sales they are having, are indicative of the tastes of the American people, and at the same time a fitting tribute to the "fast age" in which and of which we are. Every man wants to know all about chemistry, and geology, and literature, and history, but cannot afford to devote more than half an hour to the

acquisition of a knowledge of any one of these subjects; hence the "pocket" editions, "vest-pocket" editions, and, as we expect to see soon, the "watch-fob" editions of the works of all the prominent authors of the world. Of course much of this kind of smattering literature is worthless, and perhaps does more harm than good, but there are some subjects that can be so treated without this danger and the little work in hand is one of this kind. The author points out the resources of the United States, as far as he goes, very concisely and very correctly, and it is well worth the price to any reader, old or young.

HONEST MONEY AND LABOR, by Hon. Carl Schurz; NATIONAL BANKING, by M. L Scudder; HINDRANCES TO PROSPERITY, by Simon Sterne. G. P. Putnam's Sons, New York. M. H. Dickinson, Kansas City; 25c each.

These are Nos. XI, XII, and XIII, of the "Economic Monographs" published by the New York Free Trade Club, and, as the names of the distinguished authors guarantee, are valuable and reliable contributions to the literature of finance and political economy.

We have also received from the same firm Nos. 1 to 5 of the Sanitary Series of Hampton Tracts, consisting of "The Health Laws of Moses, and Who Found Jamie?" by Helen W. Ludlow; "Preventable Diseases, and A Haunted House," by Mrs. M. F. Armstrong, and "The Duty of Teachers," by E. W. Collingwood—all of which are plain, practical treatises, or monographs, upon important subjects which should be more fully understood by parents and instructors. Ten cents expended in each one of these tracts will be well laid out.

TRANSACTIONS OF THE KANSAS ACADEMY OF SCIENCE—1877 and 1878. Geo. W. Martin, Topeka, Kansas.

We are indebted to the Secretary, Mr. E. A. Popenoe, for a copy of the above named work, which is a credit to his skill and taste as a book-maker as well as to his ability and zeal as a writer and original investigator.

The Kansas Academy of Science, though young in years, has, through the untiring efforts of such men as Professors Mudge, Snow, Adams, Williston, Kedzie, and others, placed itself among the foremost societies of the country, and its reports will be more and more in demand as it is enabled by liberal state aid to prosecute its work. Several of the most valuable papers in this report have already appeared in the REVIEW, and others will be published hereafter, either in full or in condensed form.

TWO MONTHS IN EUROPE. By O. R. Burchard, A. M. Syracuse, N. Y.: Davis, Bardeen & Co. 168 pp, 8vo, paper; 50c.

Professor Burchard, having snatched two months from his labors as instructor in the Normal School, Fredonia, N. Y., in the summer of 1873, devotes 168 pages to informing the public, in a very pleasant and easy style, what he saw and how little it cost him. He seems to have made the grand continental tour, in-

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cluding Scotland, England, Belgium, Germany, Switzerland, Italy and France, and seen about all that is worth seeing, in eight weeks and for the moderate sum of five hundred dollars. Cook's patent tours are made now for a much smaller sum, but necessarily with less satisfaction, as the whole trip is on the "right through without change of cars" plan, and we think we should prefer Prof. Burchard's manner of doing it, even at a slightly increased expense.

REPORT OF THE OBSERVATIONS OF THE SOLAR ECLIPSE—July 29, 1878. Made at Fort Worth Texas.

The party making these observations consisted of Messrs. Leonard Waldo and R. W. Willson, of Harvard College; Prof. J. K. Rees, of Washington University; W. H. Pulsifer, of St. Louis, and F. E. Seagrave, of Providence, R. I. The special end in view was the observing and recording of such phenomena as might aid in establishing the correct theory regarding the corona which surrounds the sun during a total eclipse. The observations made at Fort Worth are regarded as particularly valuable, and this report comprises the individual records and calculations made by each of the above named gentlemen, and is presented in a handsome quarto volume, published at Cambridge, Mass., illustrated with several photographic illustrations showing different phases of the sun at different periods of the eclipse. We published an abstract of the less technical portion of this report in the August, 1878, number of the REVIEW.

OTHER books and pamphlets received, which will be noticed hereafter: Proceedings of the Academy of Natural Sciences of Philadelphia, Part III, September, October, November and December, 1878; edited by Edward J. Nolan, M. D.—Report of Davenport Academy of Natural Sciences, January 1, 1879.—On the Double Stars discovered by Mr. Alvan G. Clark, by S. W. Burnham, Chicago, April, 1879.—Kansas State Historical Society, First Biennial Report, January 21, 1879, by Judge F. G. Adams, Secretary.—The Twelfth Annual Session of the Missouri Press Association, May, 1878, edited by M. B. Chapman, Secretary.—Speech of Hon. B. J. Franklin, M. C., upon the Indian Question, Oklahoma Territory.—The Silk Worm; a Manual of Instruction for the Production of Silk, by Prof. C. V. Riley.—Remarks on Fossil Shells from the Colorado Desert, by Robt. E. C. Stearns, March, 1879.—Address of Prof. J. K. Edgerton, M. D., at Fort Wayne Medical College, on Education and the Medical Profession in Indiana.—The Cultivation of Chemistry, by F. W. Clark, S. B, University of Cincinnatl, O., an abstract of which excellent address was published in the REVIEW for September, 1878.—Biennial Report of the University of Kansas, 1877-8.—Nineteenth Biennial Report of Board of Managers of Missouri Lunatic Asylum, Fulton, Mo., 1878.—Biennial Report of the State Agricultural College, Manhattan, Kansas, 1877-8.—Catalogue of Oberlin (Ohio) College, 1878-9.—Kansas City in 1879, McEwen & Dillenback.—Leadville and Ten-Mile, H. T. Wright & Co., 1879, 25c.

EDITORIAL NOTES.

In commencing upon the third volume of the REVIEW, we again present our thanks to our exchanges for their many favors and kind words during the past year, and to all of our subscribers and patrons for their aid, but especially to the citizens of this city, who have been its chief support at all times and without which the REVIEW would have succumbed long since.

We are aware that some of this cordial support is due to the pride which the Kansas City people take, and have always taken, in any commendable enterprise originating here, but we are also satisfied that most of it is due to genuine appreciation of a work which every intelligent citizen must admit has been called forth by the literary and scientific tastes of the people of the city itself. The fact that the principal contributors to the REVIEW have been our own fellow-citizens and that their articles have been copied from it by most of the prominent scientific periodicals of this country and England show this to be so; and the large and increasing attendance at the monthly meetings of the Academy of Science also shows it beyond question. In fact, despite the most remarkable engrossment of the entire male population in business, we do not believe there is a city of its size in the West where there are so many gentlemen in the various professions and departments of trade who manage to find time for some scientific and literary recreation, nor indeed so many who have distinguished themselves in the various fields of scientific investigation and research as well as in literary exercises.

To such a people it is only necessary to suggest that the REVIEW is not, as yet, quite self-sustaining, to secure sufficient additional support to place it fully on its feet and enable its editor to do ample justice in the way of good work and fine illustrations to the excellent material offered him.

In future the REVIEW will be issued at the commencement of each month, instead of on the 15th as heretofore. This will explain why the present number is for May and not for April, as it otherwise would have been.

OWING to the fact that the official business of the editor of the REVIEW occupies all of his time during the day, rendering it impracticable for him to call upon all his friends in person, specimen copies will be sent out to many who are not now taking it, in the hope that upon examination they may be induced to subscribe. If those so receiving the REVIEW do not desire to become subscribers, they will please return the specimen numbers; otherwise, it will be understood that they like it well enough to receive it regularly.

WE are much gratified at the success our plan of giving premiums to subscribers has met with, and herewith reprint it, that all who desire to avail themselves of the offer may still do so, viz:

To any person who sends us $3.50, we will send the REVIEW for one year and any $1.50 book published by D. Appleton & Co., S. C. Griggs & Co., Robert Clarke & Co., Houghton, Osgood & Co., Roberts Bros., or J. B. Lippincott & Co.

To any one sending us $3.75, we will send the REVIEW for one year and any $2 book published by any of the above firms.

Persons desiring to subscribe for the REVIEW and purchase any book or books or subscribe for any other periodicals published or obtainable in this country, can obtain special rates by applying to the editor in person or by letter.

It is also quite a source of pleasure that so many of our old subscribers are having their back numbers bound for preservation, and that so many of our new ones are ordering the first and second volumes. As before stated, all subscribers who have lost or missed

any numbers of the first or second volume can have them supplied *gratis* by the editor, and they can also have either or both years' numbers handsomely bound in half morocco and cloth sides *for* $1 *per volume.*

BACK NUMBERS.—To any subscriber for the coming year we will furnish the back numbers of the first and second year for $2.25 each set, bound, or $1.25 each, unbound.

WE shall publish in the next issue of the REVIEW a profusely illustrated archæological article, by Prof. F. W. Putnam, of the Peabody Museum, descriptive of his remarkable discoveries in Tennessee.

THE regular lighting of Monumental Park, in Cleveland, Ohio, with the Brush electric light, commenced April 29th, being the first regular public lighting with electric light in any city in the United States. The effect fully demonstrates its success. It gives three times more light than was formerly given by 110 gas-burners, there being only twelve electric lights used. The light, under contract, costs the city $100 per year less than the gas formerly used.

WE are under lasting obligations to Hon. B. J. Franklin for a copy of Walker's Statistical Atlas of the United States, a most valuable work of reference, and one which exceeds in comprehensiveness of plan and excellence of execution anything of the kind ever published.

THE article in this number of the REVIEW upon "An Eleven Years' Period of Sun-Spot Observations," is the work of the Quaker shoemaker-astronomer, William Dawson, of Spiceland, Indiana, a self-taught mathematician and observer, who, though dependent upon his daily toil for a living, has had the zeal and energy to partly earn and partly manufacture, with his own hands, a fine telescope, which is mounted upon his humble shop, and with which he has made observations in astronomy that have rendered his name well known among the best scientists of Europe and America. His is almost a parallel case with that of Thomas Edwards, the Scottish shoemaker naturalist, recently made famous by Samuel Smiles, and it is to be hoped that equal or greater good fortune may overtake our astronomer and put him in condition to prosecute his favorite study untrammeled by the cares of bread-getting.

THE address of Dr. Fee before the Kansas City Academy of Science, March 25th, upon "The Science of Language," was a most interesting and scholarly production, and gave great pleasure to his audience. Being largely oral, we regret our inability to present it to the readers of the REVIEW.

That of Prof. B. F. Mudge, the veteran geologist of Kansas, at the April meeting, upon "Mines and Mining," although of entirely different character, was listened to by a full house with great attention and interest. Prof. Mudge uses no notes, and his manner of delivery is remarkably free and pleasant—almost conversational.

The Monthly Summary of scientific progress is becoming quite a feature of the Academy meetings, and those of Prof. Parker, at the March, and of Rev. Dr. Roberts, at the April meeting, were models in their way.

THE lecture on "The National Yellowstone Park," by Prof. W. I. Marshall, to be given at Coates' Opera House, May 9th, will be, beyond question, the most acceptable entertainment ever offered to the intelligent people of Kansas City, and the Academy of Science deserves the thanks of the community for securing for them so great a treat. Aside from Prof. Marshall's fascinating style as a lecturer, the stereopticon illustrations are absolutely superb, being from photographs of all the wonders of that marvelous region, taken by a thoroughly scientific and artistic operator, under the most favorable circumstances, and handled in the most skillful manner by Prof. Marshall's competent assistant.

THE third annual meeting of the Kansas City Academy of Science will take place on the evening of the last Tuesday in May, at which time an anniversary address will be delivered by Rev. James Marvin, Chancellor of the Kansas State University; officers elect-

ed for the ensuing year, and other appropriate exercises.

THE London *Monthly Journal of Science*, one of the standard scientific periodicals of the old world, has again complimented the REVIEW by copying from its columns the able article of Prof. Nipher, of St. Louis, on "Our Conceptions of Physical Law," published in the January, 1879, issue. As this is the third time in less than one year that it has borrowed an article from us, we feel constrained to regard it as very flattering to so young and so Western a journal.

THE May number of *Harper's Magazine* is very richly illustrated, containing over 100 engravings that may confidently challenge comparison. The illustrated subjects offer unusual opportunities for picturesque treatment. Among the very many excellent articles, none exceeds in interest to the lover of art that upon "The Study of Art in Boston" —an admirable and comprehensive treatment of the subject by George P. Lathrop, with twenty-eight fine illustrations. After showing what, and by what methods, the student in the Boston schools learns of Art, the remainder of the paper is a description of the Boston Art Museum, with its principal and subsidiary art schools. William Blaikie's paper on "The Risks of Athletic Work" is timely and important — well worth the thoughtful perusal of all college students and others who are liable to be carried away by the recent tide of muscular strain which is upon us. The "Editor's Easy Chair," besides much that is interesting in the way of social and literary gossip, has a timely discussion of the present outlook of the question of international copyright. The "Literary Record" is ample and incisive. The "Scientific Record," with its full review of scientific progress, meets a want not otherwise as well ministered to in current literature; and the "Editor's Drawer" contains a rich fund of amusement for every class of readers.

THE discussion in the *North American Review* for May of the question of "Law or Design in Nature," by such able, learned and liberal men as Prof. Newcomb, Prest. Noah Porter, Rev. James Cook, James Freeman Clarke, D. D., and President James McCosh, is one that must necessarily be productive of good in settling the hitherto irreconcilable points of difference and questions of belief between scientists and theologians, from the fact that they will be compelled to state the points under discussion plainly and clearly to start with, and to confine themselves to them afterward. It will also be a means of driving off many of the bugaboo notions of certain good people who seem afraid to have the long revered teachings of the Bible ventilated and examined under the light of late scientific discoveries.

The article on "Recent Progress in Applied Science," by Prof. Henry Morton, is highly interesting and readable.

WE learn from *Science News* that Prof. J. H. Allen, of the Zoological Museum at Cambridge, Mass., has a work in press upon the Primipedia or "fin-footed" marine mammals, such as the sea-elephant, whales, seals, walruses, dolphins, etc., which is the most elaborate that has ever appeared upon the subject; giving classification, description and geographical distribution of each species, as well as geological history of the group. This is a department of science never before fully written up, and we await the appearance of the work with great interest.

FROM the three numbers of the *Index Medicus*—edited by Dr. John Billings, U. S. A., and Dr. Robert Fletcher, M. R. C. S., of England—which have been received up to this time, we are satisfied that it will be a most useful and valuable work to physicians everywhere, and we know that its preparation in so good a form must be a very laborious task for its editors and compilers. Washington, D. C., $5 per annum.

BOTH the *United Service*, which is a handsome magazine, devoted to military and naval matters, and *Sunday Afternoon*, to which we have several times referred as the best thing of the kind published in the country, contain strong articles on arctic exploration and the

Howgate scheme of progressive colonization of the polar regions. This subject deserves the attention of Congress, and will doubtless receive it before the close of the session.

THE *Archives of Medicine* is a new bi-monthly journal of 112 pages, edited by Prof. E. C. Seguin, M. D., assisted by Drs. T. H. McBride, M. D. Mann and L. H. Stimson, with an able corps of collaborators. Published by G. P. Putnam's Sons, New York; $3 per year.

ROBT. F. CLARKE & CO. send us a pamphlet containing two lectures written by Gen. M. F. Force, the first on "Some Early Notices of the Indians of Ohio," and the second entitled "To What Race Did the Mound-Builders belong?" both of which show much research and original speculation; and the latter especially will be of great interest to archæologists and is an important contribution to the literature of the pre-historic period.

THE *Atlantic* for June will be a number of extraordinary interest. It will contain a study of a "New England Factory Town," by the author of "Certain Dangerous Tendencies in American Life;" a sharply critical paper on "Wood Engraving and its Corruptions," by Mr. W. J. Linton, the greatest living master of the art; an essay by Charles Dudley Warner; a literary study by T. B. Aldrich; an abundant installment of "Irene the Missionary;" a very striking story of New England life in one number; a humorous story of Southern life; a sketch by W. D. Howells; a criticism of the exhibitions of the Artists' Association and the National Academy; and other tales, sketches, articles and poems, besides very full "Contributors' Club" and "Literary Notices."

PROFESSOR BARFF'S article in *Van Nostrand's Magazine* for May, on "The Treatment of Iron to Prevent Corrosion," is one which should be widely read by iron manufacturers, and its principles applied to every article manufactured by them, especially such as are to be exposed to the action of the weather. From the examples given by him it is evident that he has hit upon a perfectly successful and feasible plan for accomplishing a long-looked-for desideratum in the mechanical arts.

THE *Popular Science Monthly* begins its fifteenth volume with the May number, which contains at least its usual amount of first-class articles. Messrs. Youmans have built up this journal under great difficulties, but it has now become one of the essentials to every reading man's study table, and they and the publishers are reaping a suitable reward.

OWING to the sad bereavement of the genial Permanent Secretary of the A. A. A. S., Prof. F. W. Putnam, he has been prevented from activity in arranging the preliminaries for the Saratoga meeting. He therefore delegated his powers to Prof. H. C. Bolton, of Trinity College, Hartford, and to Prof. D. S. Martin, of Rutger's Female College, New York City, as a committee of two. Dr. Bolton's previous experience in these matters will be of the greatest benefit to the Association as well as to the local committee at Saratoga, whose President is Dr. R. C. McEwen, and Secretary Prof. H. A. Wilson.

The Saratoga meeting begins August 27th, and a very large attendance is expected. The Appalachian Club, the Entomological Club, and the Anthropological Association meet at Saratoga at the same date, and their members will swell the numbers attending the Association.

WE are indebted to W. A. Lee, Esq., of Winfield, Kansas, for a sketch of a spinal vertebra and portion of a rib of a mastodon discovered in Sumner county by Dr. Cooper. The bones were found about two feet under ground, but apparently the original surface had been about thirty-three feet higher than at the time the discovery was made. The vertebral bone is about ten inches in vertical height and eleven across from process to process, and not less than three and one-half inches thick. The rib was traced about eight feet, but as this measurement exceeds anything of the kind hitherto described, it is probable that the trace represented two ribs lying together.